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Louisiana Barrier Island Comprehensive Monitoring Program (BICM) Volume 1: Barrier Shoreline Post-Storm Assessment Part 4: Historic Photo-Pairs/Time Series

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LOUISIANA BARRIER ISLAND COMPREHENSIVE MONITORING PROGRAM (BICM)

Volume 1: Barrier Shoreline Post-Storm Assessment

Part 4: Historic Photo-Pairs/Time Series

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**US Army Corps
of Engineers®**

Louisiana Barrier Island Comprehensive Monitoring Program (BICM)

Volume 1: Barrier Shoreline Post Storm Assessment

Part 4: Historic Photo-Pairs / Time Series

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Introduction

The Louisiana Department of Natural Resources Office of Coastal Restoration and Management (LDNR) has implemented a Barrier Island Comprehensive Monitoring (BICM) Data Collection Program with science support from the Pontchartrain Institute for Environmental Sciences (PIES) at the University of New Orleans (UNO). UNO collected and analyzed data to facilitate the LDNR/Coastal Restoration Division (CRD) activities of barrier shoreline planning, design, maintenance, monitoring, and storm impact assessment. The baseline data collection effort and data delivery necessary to establish and develop the LDNR BICM program will provide invaluable information for future efforts involving restoration along Louisiana's sandy shorelines. The effects of the 2005 Hurricane season in Louisiana and subsequent development of integrated hurricane protection and coastal restoration planning programs make this an appropriate time to collect the baseline data necessary for understanding the past and planning for the future.

The Barrier Shoreline Post Storm Assessment consists of 5 Parts:

Part 1: 2005 Post Hurricanes Katrina and Rita Photography

Part 2: 2006/2007 Aerial Survey Photography

Part 3: 2005 – 2006/2007 Photo-Pairs

Part 4: Historic Photo-Pairs/Time Series

Part 5: 2006/2007 Aerial Video Survey

Part 4 includes:

1. Report

- a. Location diagrams for the seventeen Time Series divided by region with the OSRADP satellite imagery as a background.
- b. Tables listing photography used for each time series by date and by site
- c. Water levels data

2. A CD including:

- a. All photography used in the Time Series organized by BICM region
- b. Powerpoint slideshow for each time series
- c. Pdf slideshow for each time series
- d. Report file in Word and pdf
- e. Excel spreadsheet of the metadata tables

3. A CD containing the html web-based interface to all time series. To use this, you must open your browser, and then open the file in the “Web content” folder that is titled index2.html.

The Aerial Video Survey slide archive includes imagery from 1984 to 2007. Most images were taken from a helicopter during simultaneous video imagery capture as part of an Aerial Video Survey including the Louisiana shoreline. Along the Louisiana Gulf of Mexico shoreline, the helicopter traveled from west to east from Sabine Pass to the Mississippi River Delta, and then south to north along the Chandeleur Islands. The bays were recorded by keeping the undulating shoreline on the left side of the helicopter. The altitude was usually 200-300 ft other than at the end of islands where the altitude was increased to 700 feet or more for a longshore view. The ground speed varied depending on the character of the shoreline and the altitude but averaged around 55 miles per hour.

Between 1984 and 1992, photos were taken by different people with different interests and goals, so early photos are not always available at every location of interest. Later areas of interest and photo techniques were more standardized to produce imagery that could be more closely compared. Images from any two flights can be paired to produce “photo-pairs” for illustration of landscape changes for the selected time-periods. Imagery selected from more than two surveys are considered a “Time-series.” The term “Historic Photo-pairs” has been replaced by the more descriptive “time series” for the series of historical images that encompass several time periods at each site, to avoid confusion with “Photo-Pairs” in Part 3 that presents a comparison between only the two most recent time periods.

Funding for the video and photographic coastal surveys that compose the historical slide archive came from a variety of agencies, industries and foundations, including: Exxon Mobil Corporation, Marine Spill Response Corporation, Clean Gulf Associates, Unocal Corporation, SONAT, Inc., Texas Bureau of Economic Geology and Louisiana Oil Spill Research and Development Program. Funding for the acquisition of 2005 post-hurricanes Katrina and Rita photography was provided by the U.S. Geological Survey Coastal & Marine Geology Program in St. Petersburg, FL. Funding for the acquisition of 2006/2007 photography was provided by LCA Science & Technology Program, a partnership between the LDNR and the US Army Corps of Engineers (USACE), through LDNR Interagency Agreement No. 2512-06-06.

Project Location

The LDNR BICM Program encompasses the mainland shoreline of the south Louisiana coast with special emphasis on the sandy beaches and barrier islands. Louisiana’s mainland shoreline stretches 450 miles east from Sabine Pass on the Texas/Louisiana Border to the Pearl River on the Mississippi/Louisiana. Between Texas and Mississippi, Louisiana encompasses four distinct geologic regions: 1) Chenier Plain, 2) Acadiana Bays, 3) Mississippi River Delta Plain, and 4) the Pontchartrain Basin (Figure 1).

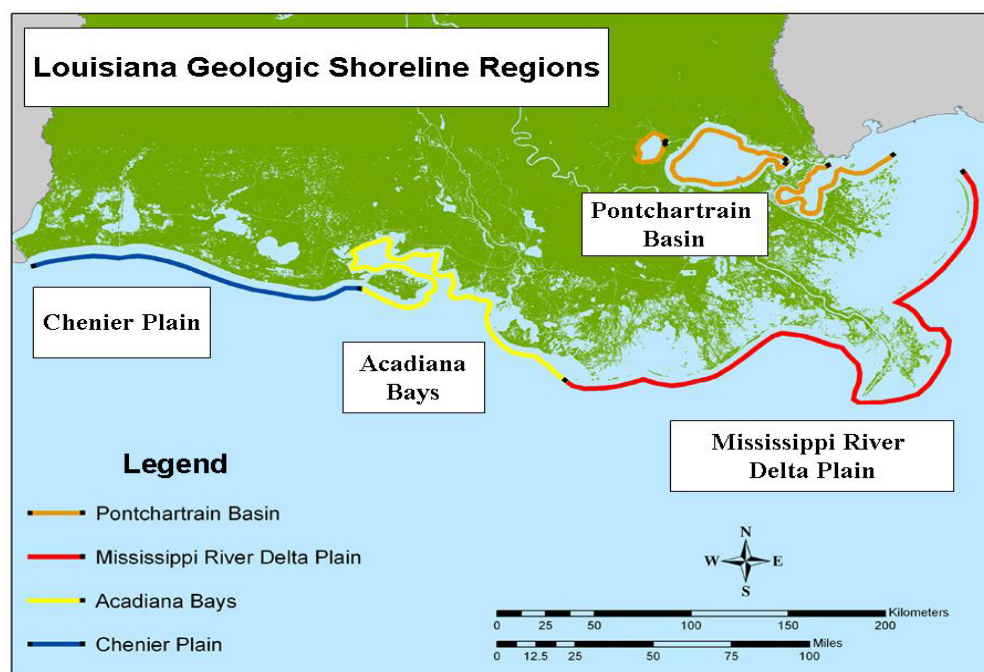


Figure 1. Louisiana's Geologic Shoreline Regions.

BICM further divided the coastline into eight regions: Western Chenier Plain, Eastern Chenier Plain, Acadiana Bays, Teche Delta, Lafourche Delta, Modern Delta, Chandeleur Islands, and the Lakes Region (Figure 2).

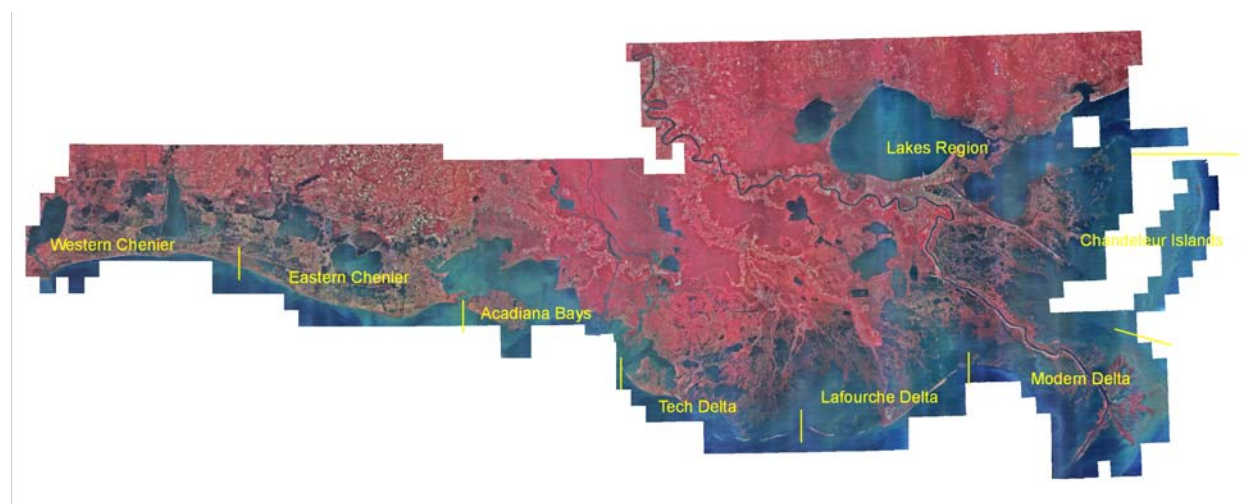


Figure 2. BICM divides coastal Louisiana into eight regions. The 1984-2007 time series are only along 6 of the regions.

The most consistent photography in the archives occurs along the sandy shorelines of Louisiana. Therefore, the best time series with the most complete records are along these shorelines. 17 time series were constructed along the Louisiana outer coast, along Western

Chenier, Eastern Chenier, Teche Delta, Lafourche Delta, Modern Delta and Chandeleur Island Regions, representing six of the eight BICM coastal regions.

Methodology

Slide archives for each survey had to be manually searched for possible matches. Some potential areas had more consistent coverage through the years than others. A number of locations were assembled before determinations could be made as to which would be most appropriate and most illustrative of the changing conditions of the area.

Each slide for the selected time series had to be physically cleaned, digitally scanned, digitally color balanced or enhanced, digitally cleaned, annotated and filed. A folder was created for each potential time series containing all files related to that location, including scanned slides and digital files from more recent photo surveys. Most scanned slides were archived at 600dpi 4x6 inch format. Some from other sources were archived at 300dpi 4x6 format.

The time series for each location was assembled in Adobe PhotoShop. The images were overlaid in PhotoShop and laid on a grid to match scales. At times it was necessary to digitally “stretch” an image to enhance the visual relationship because of the perspective produced by a difference in altitude or camera angle. Once images are matched, scaled, adjusted and cropped, the images were individually “flattened” onto a set-size background to maintain the inter-relationship, and saved as individual jpegs.

These individual jpegs were then assembled into a Powerpoint slideshow to add various labels, markers, dates and information. The finished PowerPoint is then saved as a pdf file for web-serving. Both PowerPoint and pdf slideshow are on the accompanying CD.

None of the historical slides were associated with a GPS file with detailed metadata. Slides associated with video after 1990 could be manually associated to the GPS encoded on the video imagery, when necessary. Locations listed in the data tables are generally based on the GPS from the 2001 Aerial Video Survey and the 2001 slides. Locations of each time series are indexed on an html file that can be accessed and manipulated on the web or by a web browser. Table 1 shows the dates of acquisition for the photography used in the time series.

Table 1. Dates of photography used for the time series.

Western Chenier Plain	Teche Delta	Modern Delta - Plaquemine
Eastern Chenier Plain	Lafourche Delta	Chandeleurs
Date	Date	Date
July 8, 1984	Coastal - July 9, 1984	Coastal - July 8-9, 1984
July 9, 1985	Coastal - July 10, 1985	pre-hurricanes - July 10, 1985
Post-Danny - Aug 24, 1985	Post-Danny - Aug 24, 1985	
Post-Juan - Nov 6, 1985	Post-Juan - Nov 6, 1985	Post Juan - Nov, 1985
July 22, 1986	Coastal - July 23, 1986	Coastal - July 24, 1986
July 7, 1987	Coastal - July 9, 1987	Coastal - July 9, 1987
July 13, 1988	Coastal - July 14, 1988	Coastal - July 14, 1988
	Post-Gilbert Oct 12, 1988	Post-Gilbert - Oct 12, 1988
July 18, 1989	coastal - July 19, 1989	Coastal - July 19, 1989
June 24, 1990	Coastal - June 25, 1990	Coastal - June 25, 1990
July 17, 1991	Coastal - July 18, 1991	Coastal - July 18, 1991
July 7, 1992	Coastal - July 9, 1992	Coastal - July 9, 1992
Post-Andrew - Aug 29, 1992	Post-Andrew - Aug 30, 1992	Post-Andrew - Aug 30, 1992
June 15, 1993	Coastal - June 16, 1993	Coastal - June 16, 1993
July 25, 1994	Coastal - July 26, 1994	Coastal - July 26, 1994
July 11, 1996	Coastal - July 17, 1996	Coastal - July 17, 1996
		Post-Georges – October 1, 1998
	Coastal - August 27, 1999	Coastal - August 27, 1999
June 13, 2001	Coastal - June 14, 2001	Coastal - June 14, 2001
	Pre-TS Isodore - June 25, 2002	Pre-TS Isodore - June 25, 2002
	Post-TS Isodore - Oct 1, 2002	Post-TS Isodore - Oct 1, 2002
	Post-Lili - Oct 5, 2002	Post-Lili - Oct 5, 2002
	Pre-Ivan - Sept 13, 2004	Pre-Ivan - Sept 13, 2004
	post-Ivan - Sept 18, 2004	post-Ivan - Sept 18, 2004
post-Rita - Sept 28, 2005	post-Rita - Sept 30, 2005	post-Rita - Sept 30, 2005
November 20, 2006		
	Coastal - February 26, 2007	Coastal - February 26, 2007
	Coastal - April 20, 2007	Coastal - April 20, 2007

Water level

Table 2 lists the mean range, spring range, and mean tide level for various stations along the Louisiana coastline. The table is modified from the NOAA website:

<http://tidesandcurrents.noaa.gov/tides07/tab2ec4.html#108>. Areas not represented by time series were deleted from the list.

Table 2. Mean Range, Spring Range and Mean Tide Level in feet for tide gages along the Louisiana coast.

Station	Latitude	Longitude	Mean Range (ft)	Spring Range (ft)	Mean Tide Level (ft)
Chandeleur Light	30° 03'	88° 52'	--	1.2	0.6
Comfort Island	29° 49.4'	89° 16.2'	1.45	1.57	0.80
Bay Gardene	29° 35.9'	89° 37.1'	1.34	1.44	0.75
Breton Islands	29° 29.6'	89° 10.4'	1.37	1.37	0.69
Empire Jetty	29° 15.0'	89° 36.5'	--	1.3	0.7
Bastian Island	29° 17.2'	89° 39.8'	--	1.2	0.6
Quatre Bayous Pass	29° 18.6'	89° 51.2'	--	1.3	0.6
Barataria Pass	29° 16'	89° 57'	--	1.2	0.6
Barataria Bay					
EAST POINT, GRAND ISLE	29° 15.8'	89° 57.4'	1.04	1.06	0.53
Bayou Rigaud, Grand Isle	29° 16'	89° 58'	--	1.0	0.5
Independence Island	29° 18.6'	89° 56.3'	--	0.9	0.4
Manilla	29° 25.6'	89° 58.6'	--	1.0	0.5
Caminada Pass (bridge)	29° 12.6'	90° 02.4'	0.99	0.99	0.50
Timbalier Island, Timbalier Bay	29° 05'	90° 32'	--	1.2	0.6
Pelican Islands, Timbalier Bay	29° 07.7'	90° 25.4'	--	1.2	0.6
Wine Island, Terrebonne Bay	29° 04.7'	90° 37.1'	--	1.3	0.6
Cocodrie, Terrebonne Bay	29° 14.7'	90° 39.7'	1.01	1.05	0.53
Caillou Boca	29° 03.8'	90° 48.4'	--	1.4	0.7
Raccoon Point, Caillou Bay	29° 03.5'	90° 57.7'	--	1.7	0.8
Ship Shoal Light	28° 55'	91° 04'	--	1.6	0.8
Atchafalaya Bay					
Eugene Island	29° 22'	91° 23'	--	1.9	1.0
Point Au Fer	29° 20'	91° 21'	--	2.0	1.0
Shell Island	29° 28'	91° 18'	--	1.5	0.7
South Point, Marsh Island	29° 29'	91° 46'	--	1.8	0.9
Lighthouse Point	29° 31'	92° 03'	--	2.0	1.0
Southwest Pass, Vermilion Bay	29° 35'	92° 02'	--	1.6	0.8
Mermentau River entrance	29° 45'	93° 06'	--	2.5	1.2
Calcasieu Pass, Lighthouse wharf	29° 47'	93° 21'	--	2.0	1.0

Few of the stations in the previous list provided data along the coast for the time periods needed, and some of these had limited data for limited periods of time. The data varied between every 6 minutes, every hour or monthly, with more detailed data available for more recent dates. The stations that could be used are highlighted in red. Data was gathered from NOAA at <http://tidesandcurrents.noaa.gov/> for the following stations:

Sabine Pass North #8778094; - data 1996-2007

Calcasieu Pass, East Jetty #8768094;

Grand Isle, East Point #8761724; - data 1996-2007

Grand Pass #8760668 – data 1980-1996

Gulfport Harbor #8745557

Monthly data was available for western Louisiana at Sabine Pass (Figure 3), central Louisiana at Grand Isle (Figure 4) and eastern Louisiana at Grand Pass or Bay St Louis, MS (Figure 5-6). This was the only data found for western and eastern areas from 1984 to 1996.

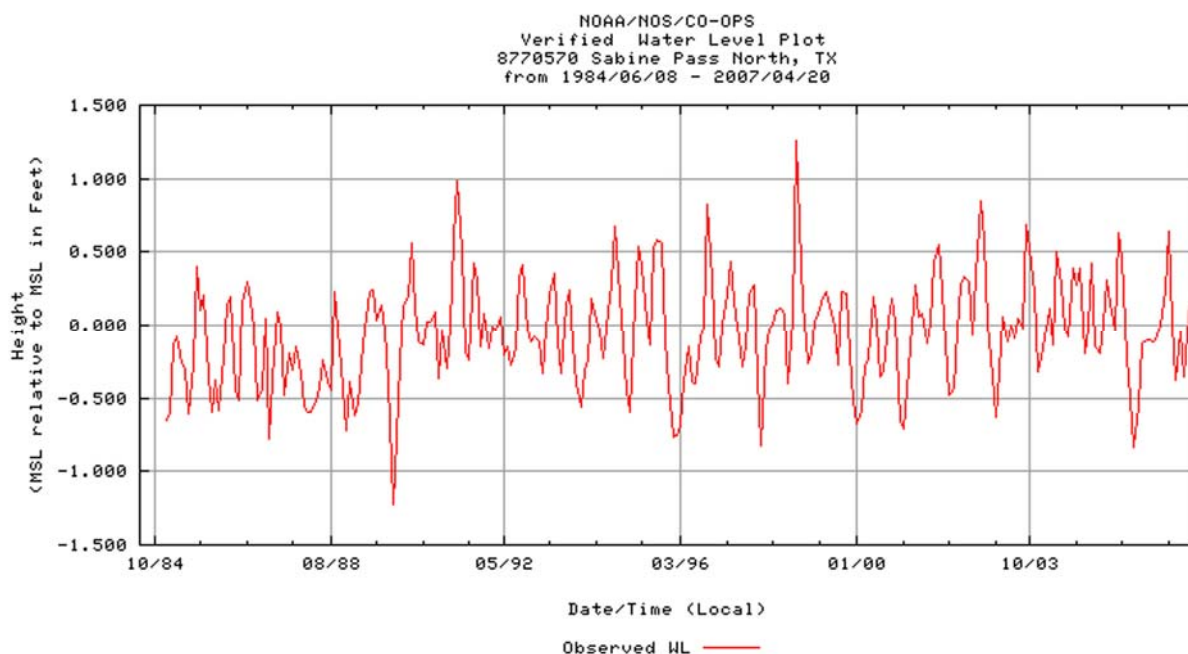


Figure 3. Monthly data available between July 8, 1984 and April 20, 2007 from the Sabine Pass North, TX gage for water levels in Western Chenier and Eastern Chenier BICM regions.

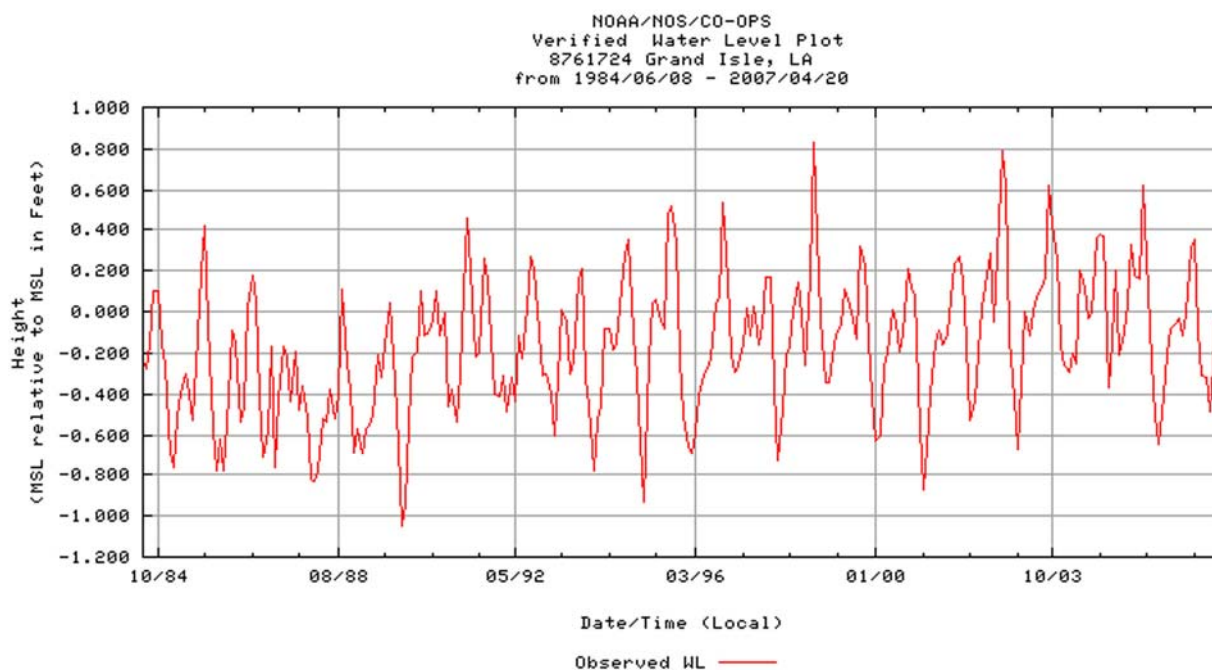


Figure 4. Monthly data available between July 8, 1984 and April 20, 2007 from the Grand Isle, LA gage for water levels in Teche Delta and Lafourche Delta BICM regions.

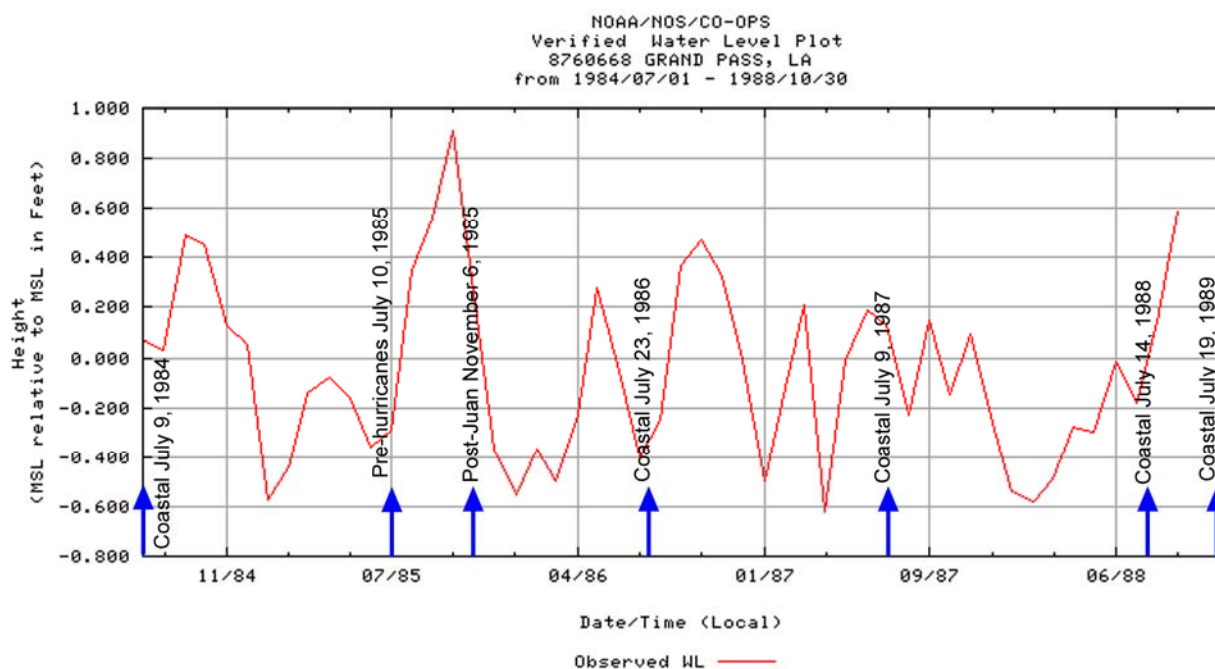


Figure 5. Monthly data available between July 8, 1984 and October 30, 1988 from the Grand Pass, LA gage for water levels in Chandeleur Islands BICM region. There was no data available after 1989.

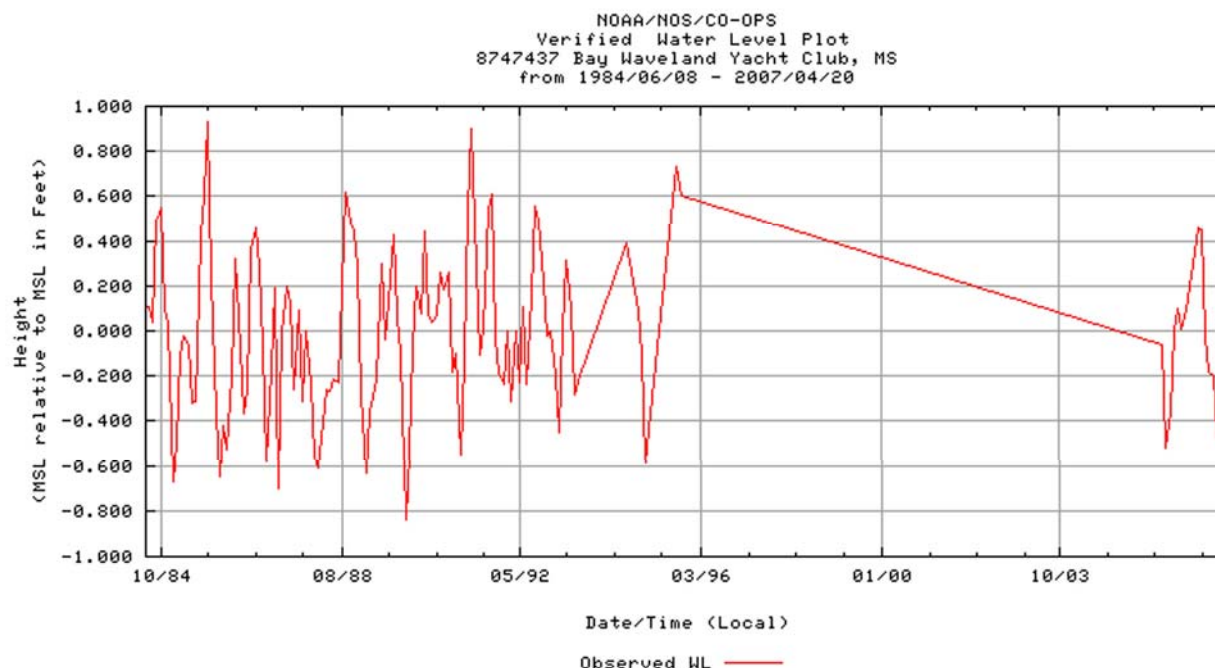


Figure 6. Monthly data available between July 8, 1984 and April 20, 2007 from the Bay St. Louis, Waveland Yacht Club, MS gage for water levels in Western Chandeleur Islands BICM region. Data was missing between Hurricane Opal in 1995 to 2004.

Figures 7-40 are graphs of the available data at 6-minute or hourly readings during photo acquisition (NOAA at <http://tidesandcurrents.noaa.gov/>.) Grand Isle had the most comprehensive detailed data. The graphs are organized by region, then by date. Photography was acquired usually between the hours of 0900 and 1700, corresponding to the center portion of the graph.

Western Chenier and Eastern Chenier BICM regions – The best data available for these regions was from the Sabine Pass North Station, and was monthly until 1992 (Figure 2), hourly from 1992 to 1996 (figures 6-10), then 6-minute reading to present (figures 11-13). (<http://tidesandcurrents.noaa.gov/>).

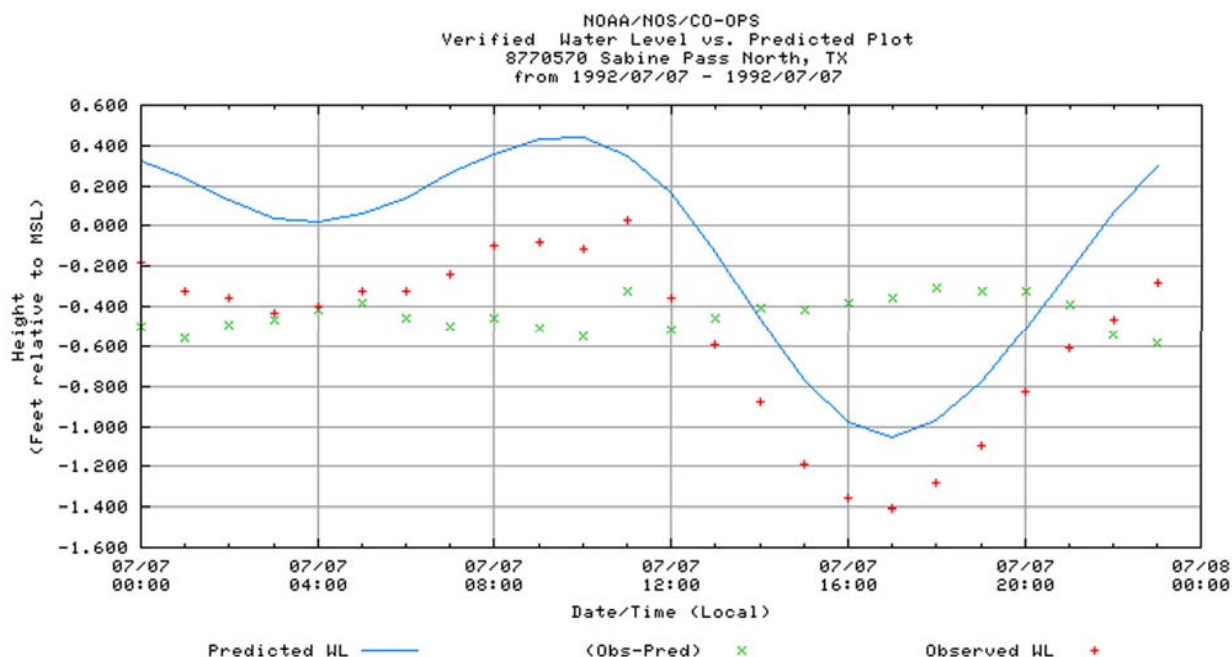


Figure 7. Hourly data available for the July 7, 1992 pre-hurricane Andrew photography from the Sabine Pass North gage for water levels in Western Chenier and Eastern Chenier BICM regions. This shows water levels half a foot lower than predicted.

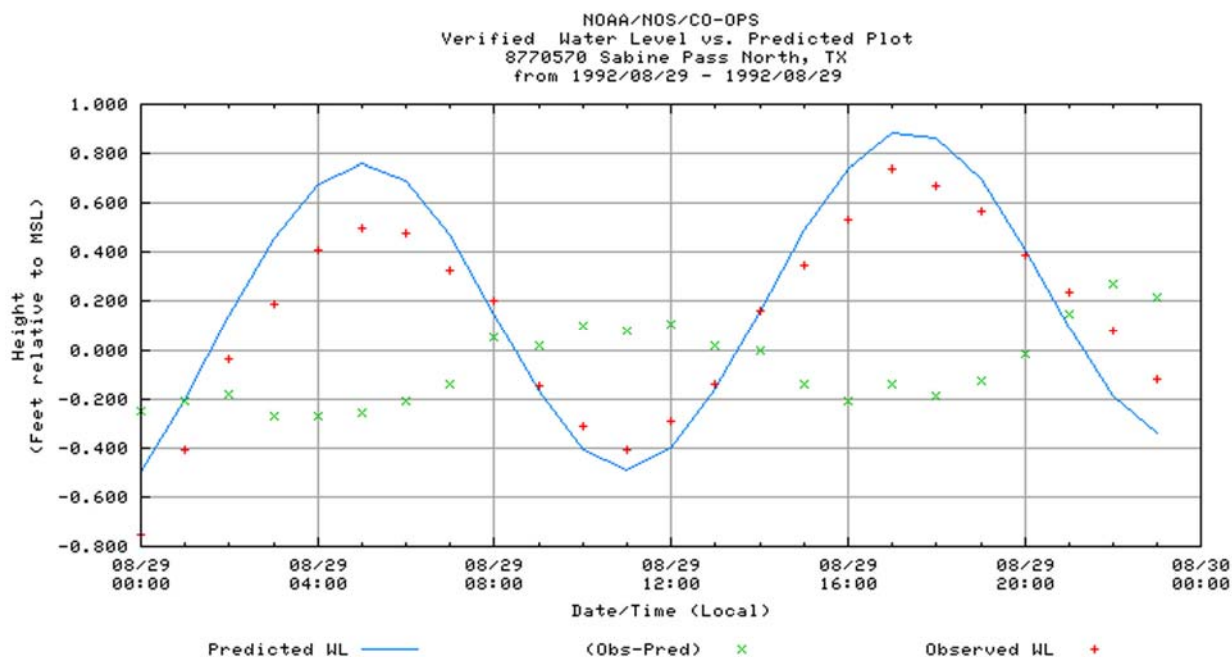


Figure 8. Hourly data available for the August 29, 1992 post-hurricane Andrew photography from the Sabine Pass North gage for water levels in Western Chenier and Eastern Chenier BICM regions. This shows the tidal range to be slightly lower than that expected.

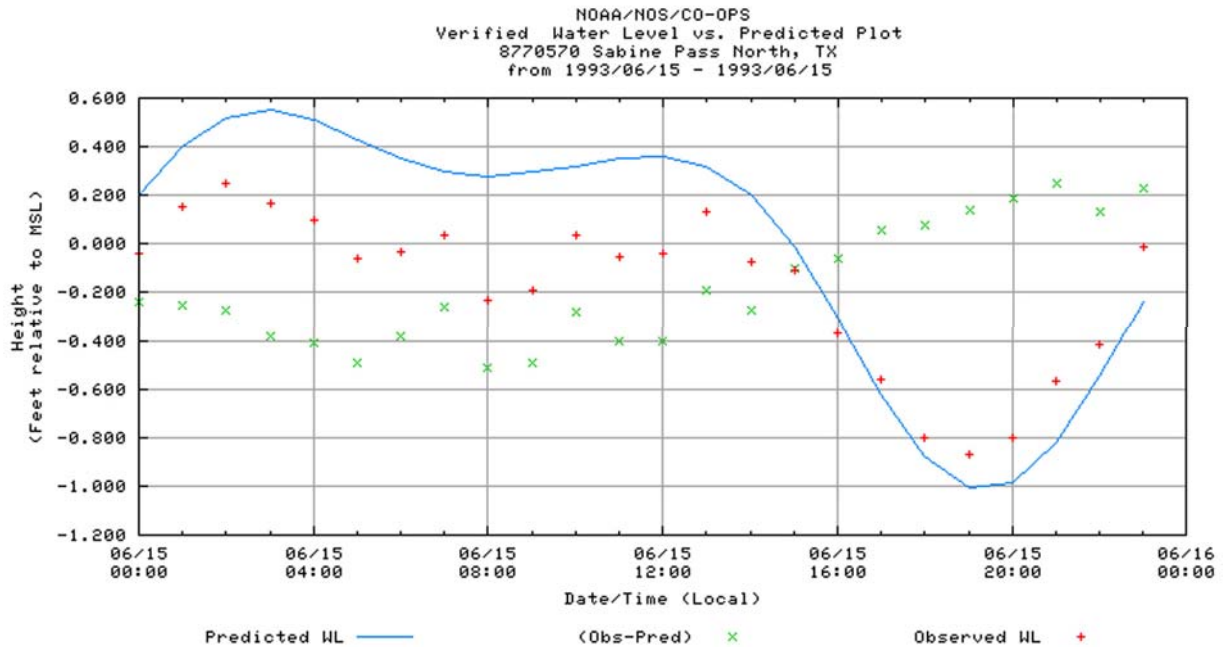


Figure 9. Hourly data available for the June 15, 1993 photography from the Sabine Pass North gage for water levels in Western Chenier and Eastern Chenier BICM regions. This shows that the tidal range was lower than expected.

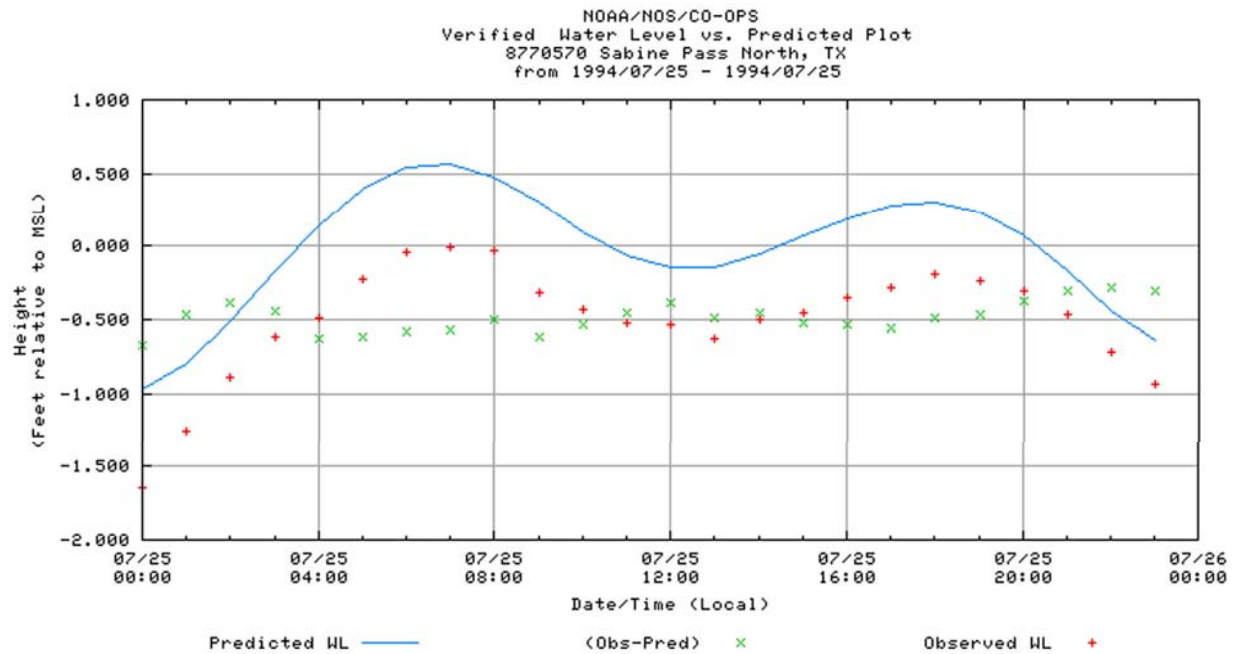


Figure 10. Hourly data available for the July 25, 1994 photography from the Sabine Pass North gage for water levels in Western Chenier and Eastern Chenier BICM regions. This shows the water levels to be about a half a foot lower than predicted.

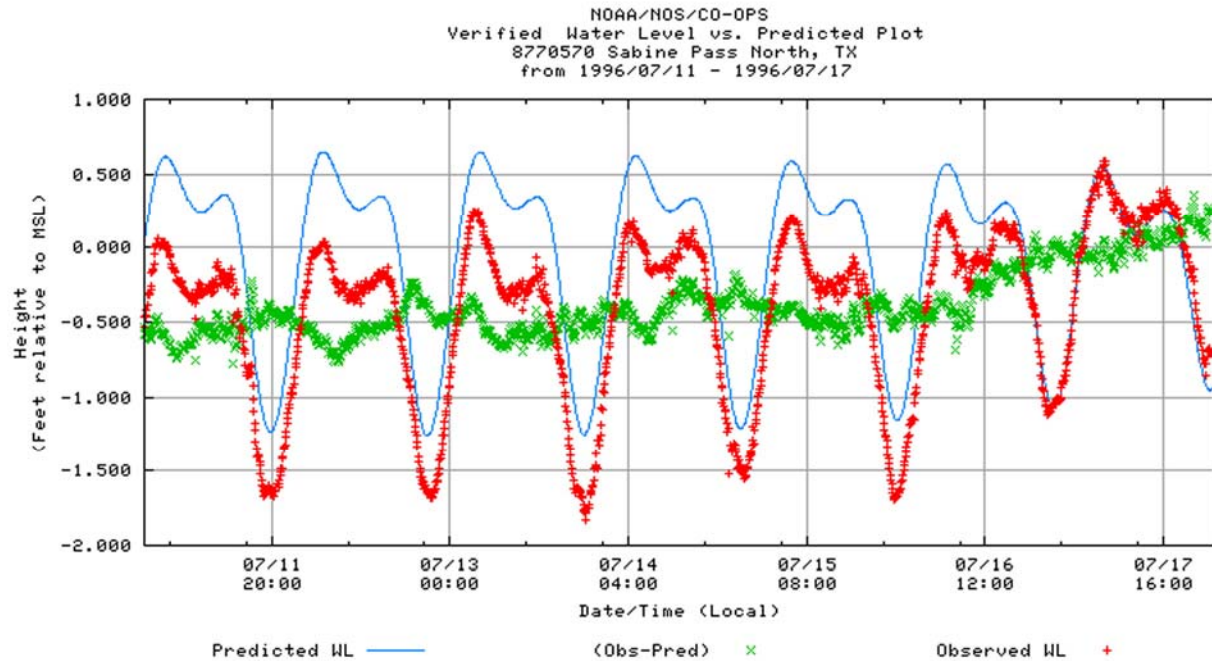


Figure 11. 6-minute data available for the July 11-17, 1996 photography from the Sabine Pass North gage for water levels in Western Chenier and Eastern Chenier BICM regions. This shows the water levels were about a half a foot lower than predicted during photo acquisition.

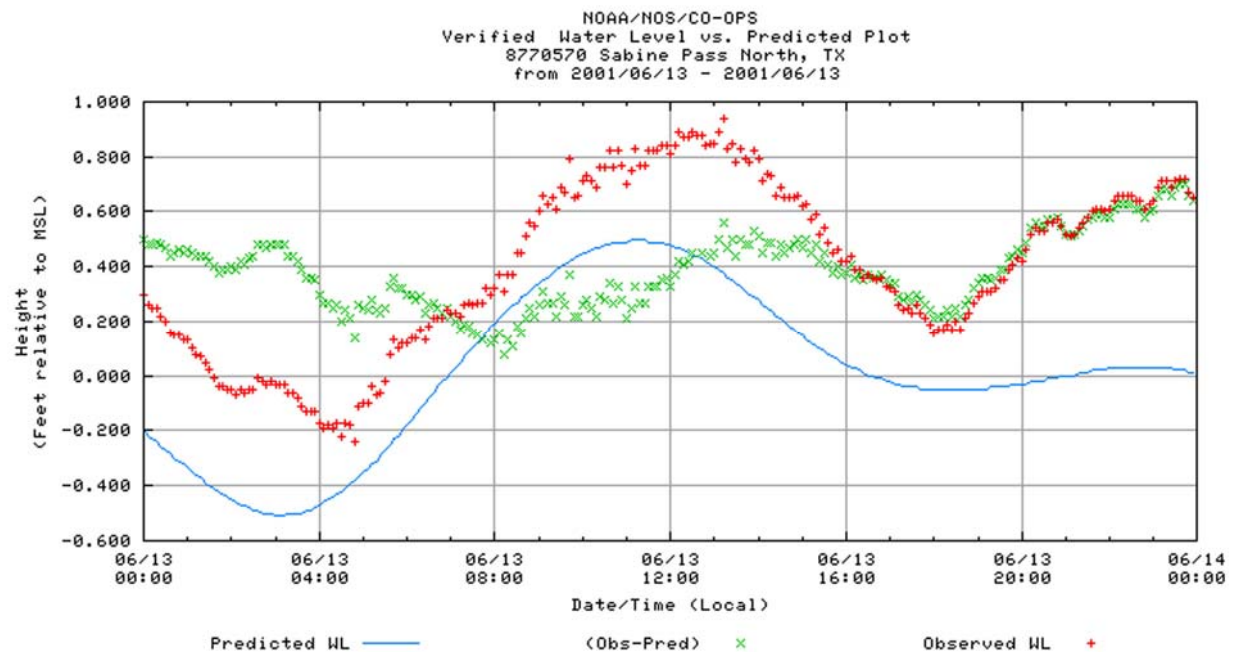


Figure 12. 6-minute data available for the June 13, 2001 photography from the Sabine Pass North gage for water levels in Western Chenier and Eastern Chenier BICM regions. This shows the water levels were about a half a foot higher than predicted during photo acquisition.

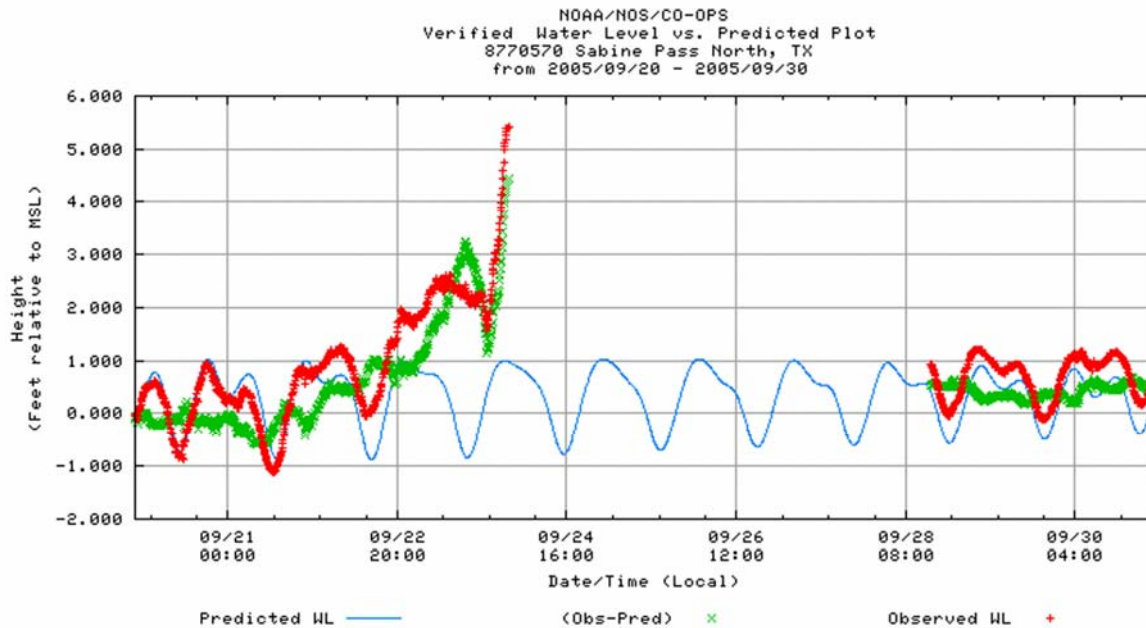


Figure 13. 6-minute data available for September 20-30, 2005 from the Sabine Pass North gage, bracketing the landfall of Hurricane Rita on 9/24 and photo acquisition on 9/28 showing the predicted and observed data for the vicinity of BICM regions Western and Eastern Chenier Plain. This shows that the water levels had returned to near normal levels by the time of photo-acquisition.

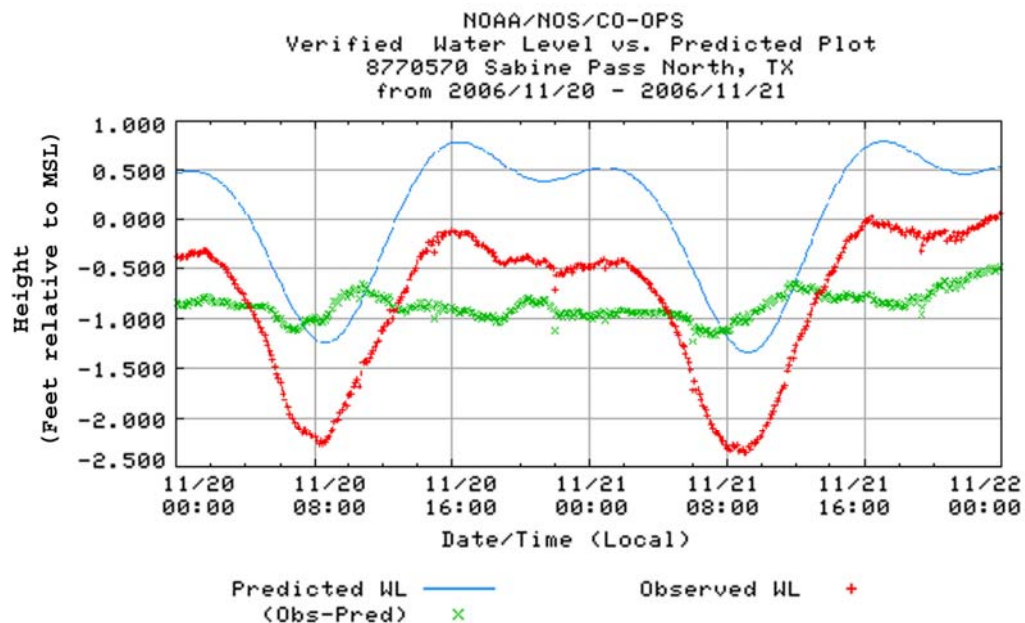


Figure 14. 6-minute data available for November 20-21, 2006 from the Sabine Pass North gage, during photo acquisition on 11/20 for western Louisiana. This shows that the water levels were roughly a foot lower than predicted for the vicinity of BICM regions Western and Eastern Chenier Plain.

Teche Delta, Lafourche Delta and Modern Delta BICM regions – The best data available for these regions was from the Grand Isle East Station, and was monthly until 1992 (Figure 4), hourly from 1992 to 1996 (figures 15-30), then 6-minute reading from 1996 to present (figures 31-38). <http://tidesandcurrents.noaa.gov>

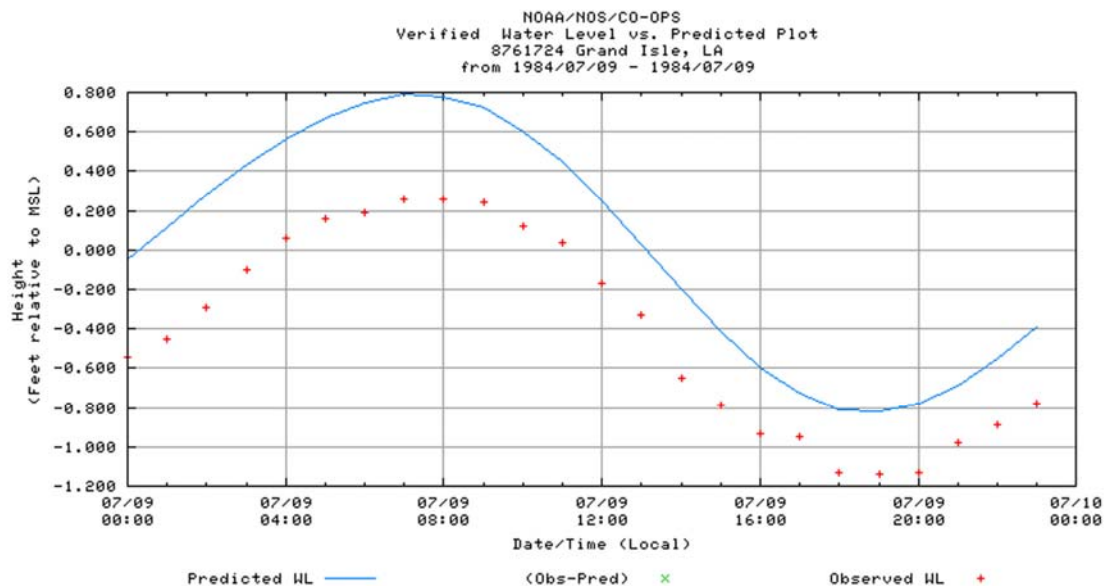


Figure 15. Hourly data available for July 9, 1984 from the Grand Isle East gage, for water levels along the central Louisiana coast during photo-acquisition. This shows water levels were half a foot lower than predicted.

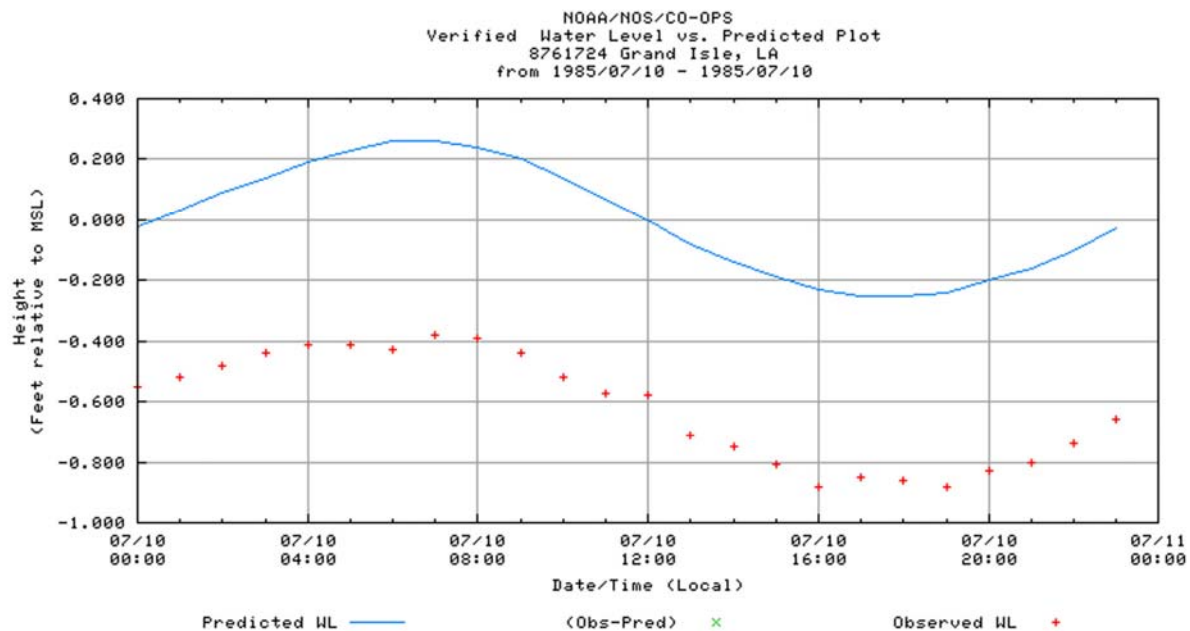


Figure 16. Hourly data available for July 10, 1985 from the Grand Isle East gage, for water levels along the central Louisiana coast during photo-acquisition. This shows water levels were half a foot lower than predicted.

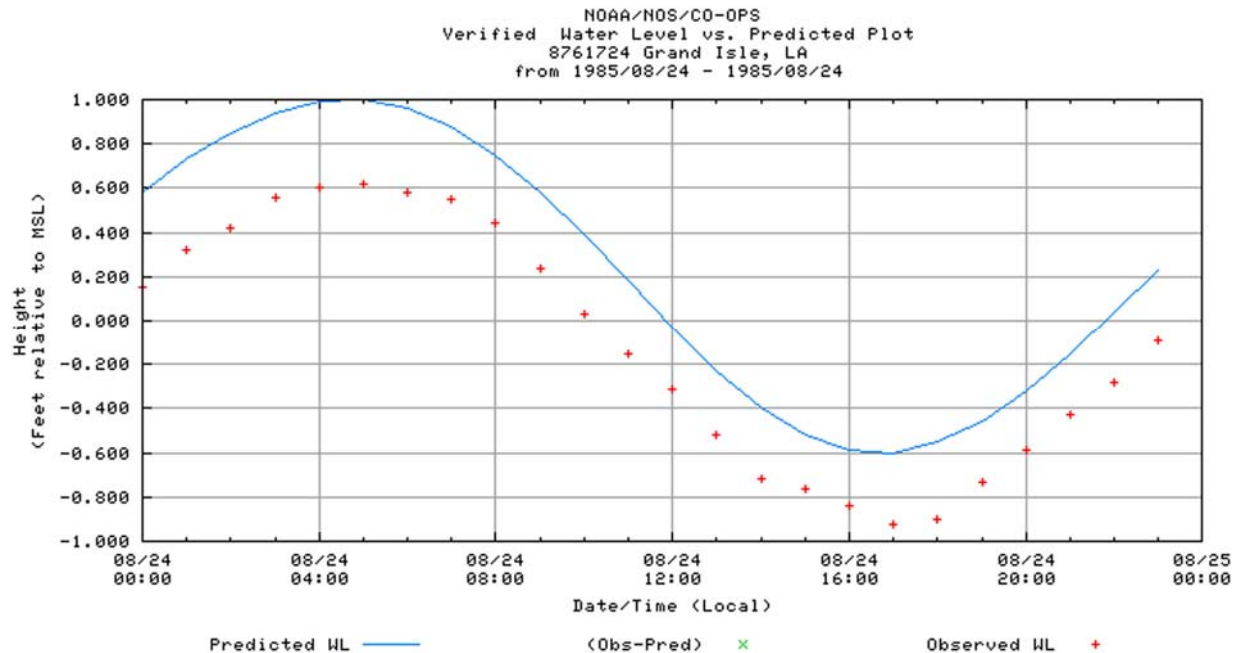


Figure 17. Hourly data available for August 24, 1985 from the Grand Isle East gage, for water levels along the central Louisiana coast during post-hurricane Danny photo-acquisition. This shows water levels were a few inches lower than predicted.

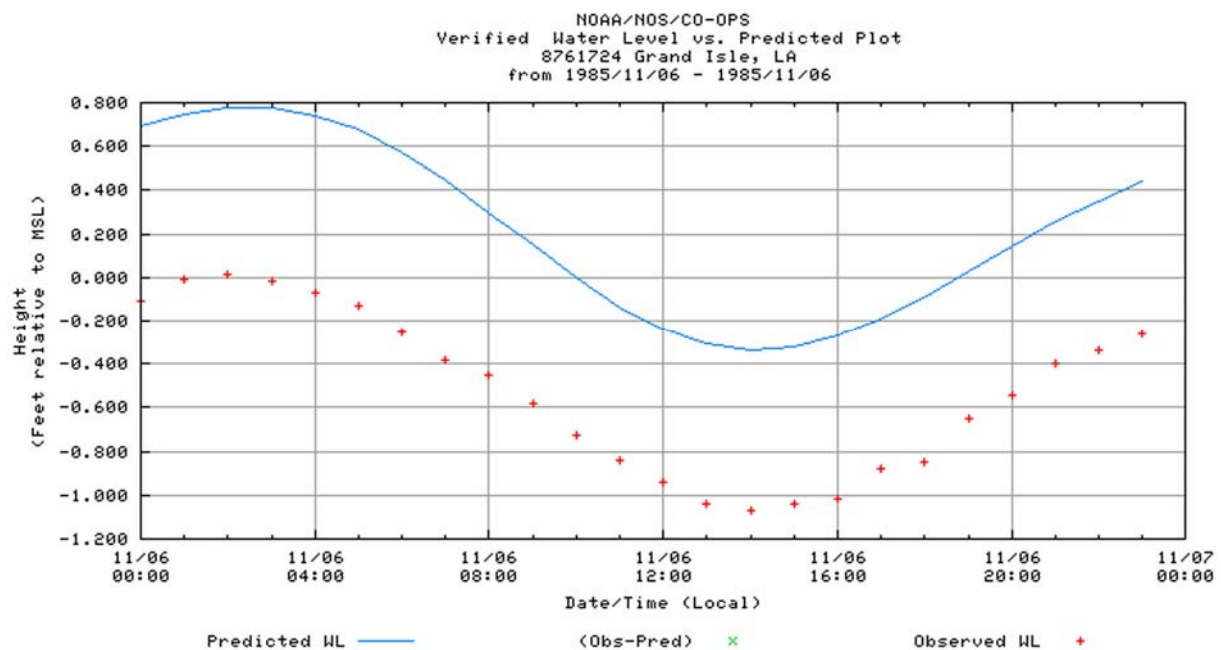


Figure 18. Hourly data available for November 6, 1985 from the Grand Isle East gage, for water levels along the central Louisiana coast during the post-hurricane Juan photo-acquisition. This shows water levels were close to a foot lower than predicted.

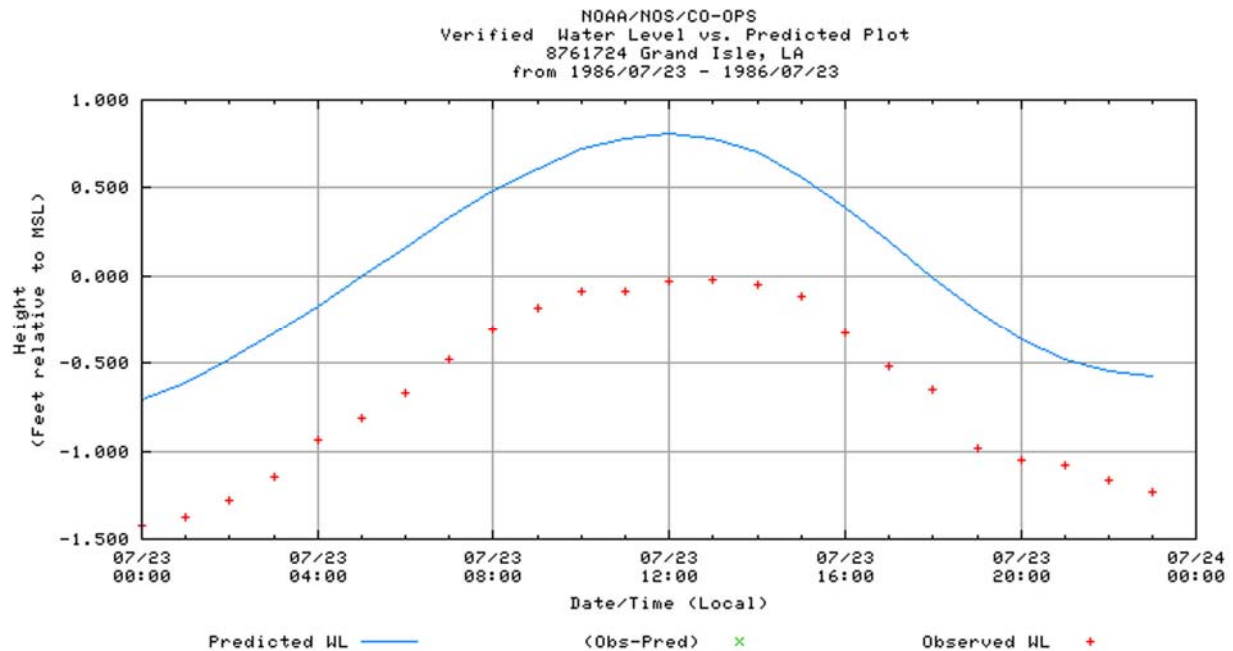


Figure 19. Hourly data available for July 23, 1986 from the Grand Isle East gage, for water levels along the central Louisiana coast during coastal survey photo-acquisition. This shows water levels were $\frac{3}{4}$ of a foot lower than predicted.

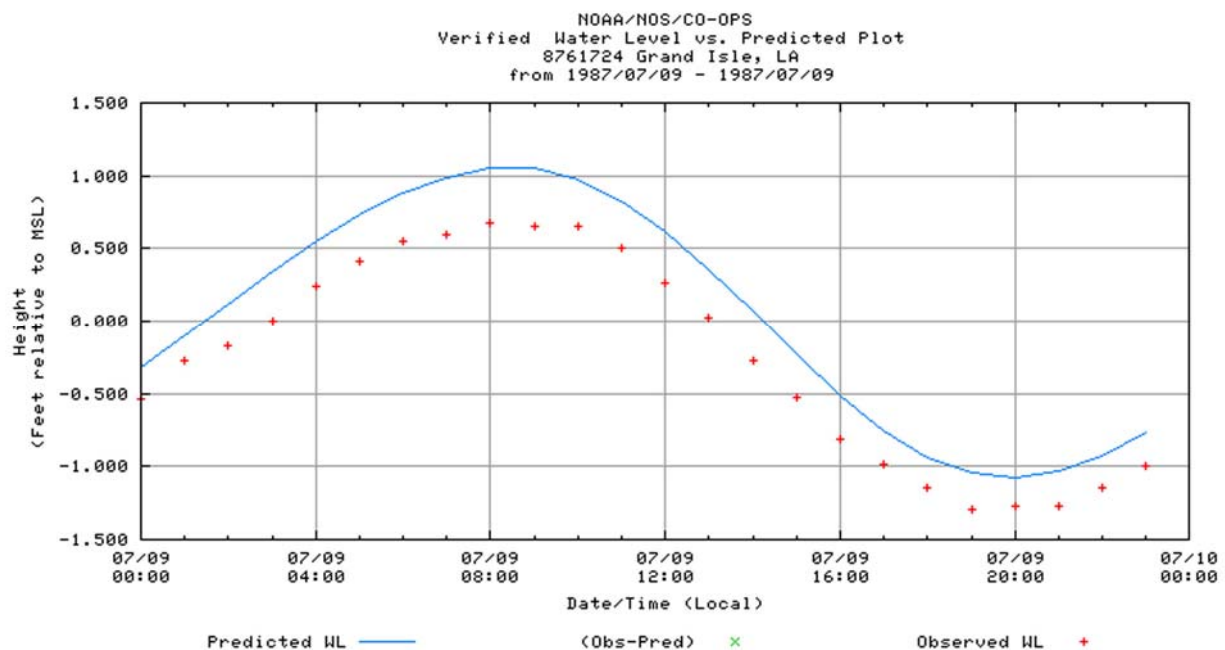


Figure 20. Hourly data available for July 9, 1987 from the Grand Isle East gage, for water levels along the central Louisiana coast during coastal survey photo-acquisition. This shows water levels were slightly lower than predicted.

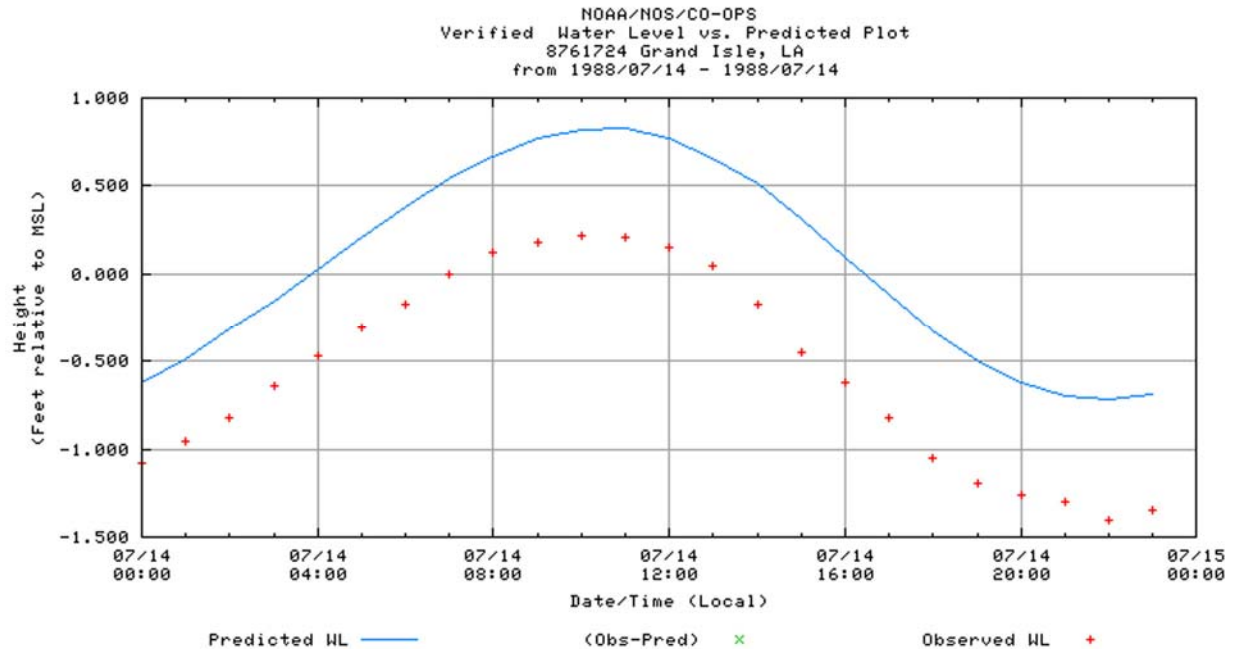


Figure 21. Hourly data available for July 14, 1988 from the Grand Isle East gage, for water levels along the central Louisiana coast during pre-hurricane Gilbert photo-acquisition. This shows water levels were half a foot lower than predicted.

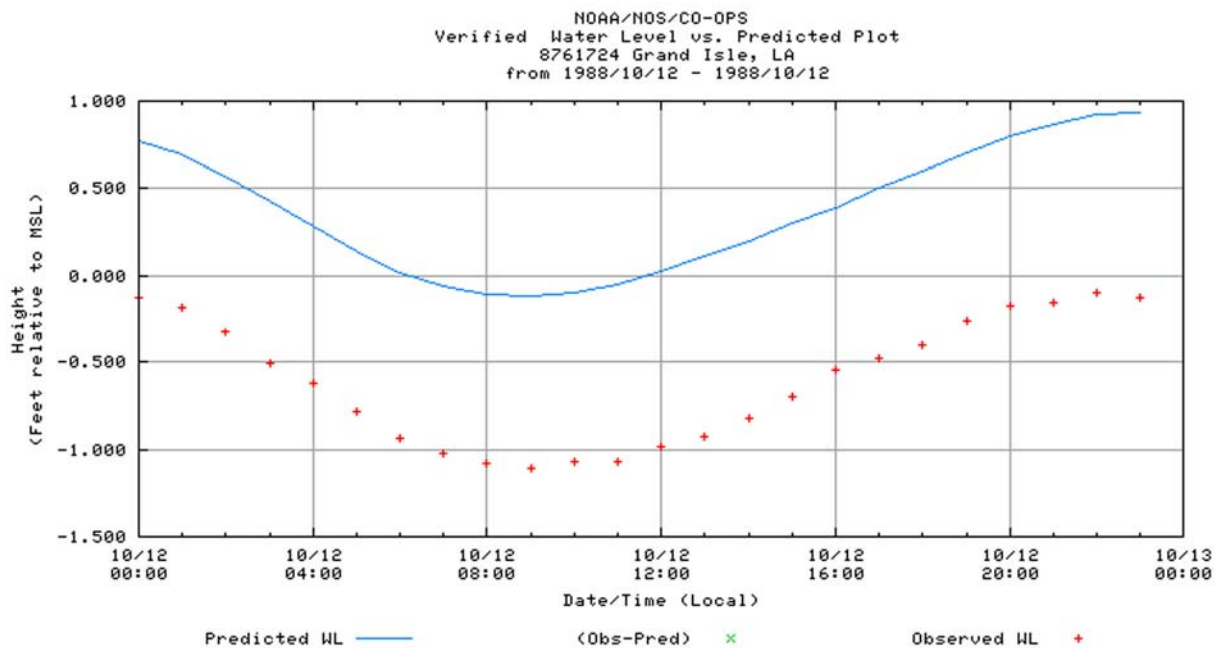


Figure 22. Hourly data available for October 12, 1988 from the Grand Isle East gage, for water levels along the central Louisiana coast during post-hurricane Gilbert photo-acquisition. This shows water levels were almost a foot lower than predicted.

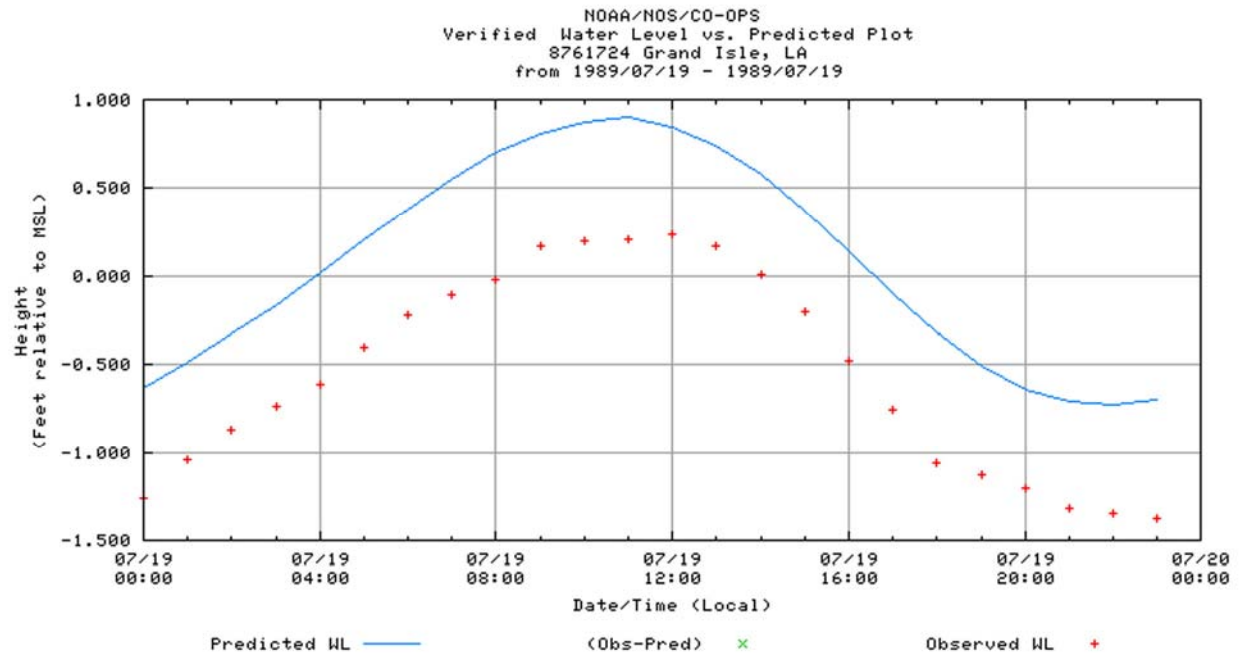


Figure 23. Hourly data available for July 19, 1989 from the Grand Isle East gage, for water levels along the central Louisiana coast during coastal survey photo-acquisition. This shows water levels were half a foot lower than predicted.

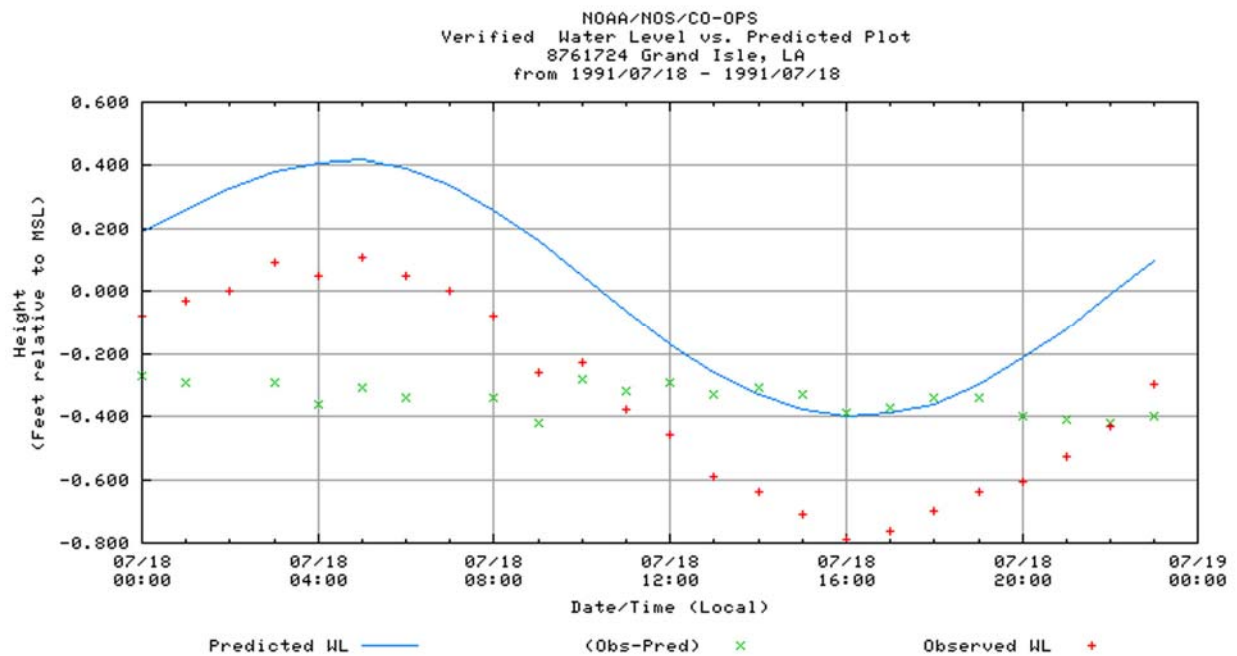


Figure 24. Hourly data available for July 18, 1991 from the Grand Isle East gage, for water levels along the central Louisiana coast during coastal survey photo-acquisition. This shows water levels were less than half a foot lower than predicted. (1990 data was only available in a monthly reading)

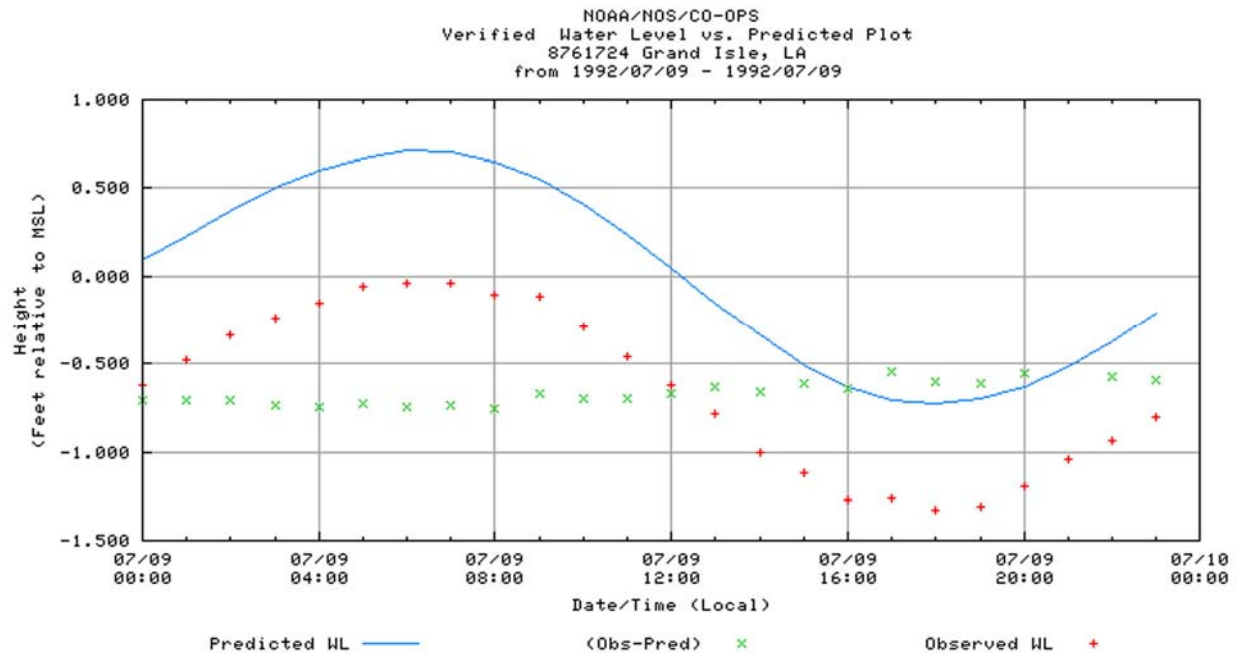


Figure 25. Hourly data available for July 9, 1992 from the Grand Isle East gage, for water levels along the central Louisiana coast during pre-hurricane Andrew photo-acquisition. This shows water levels were half a foot lower than predicted.

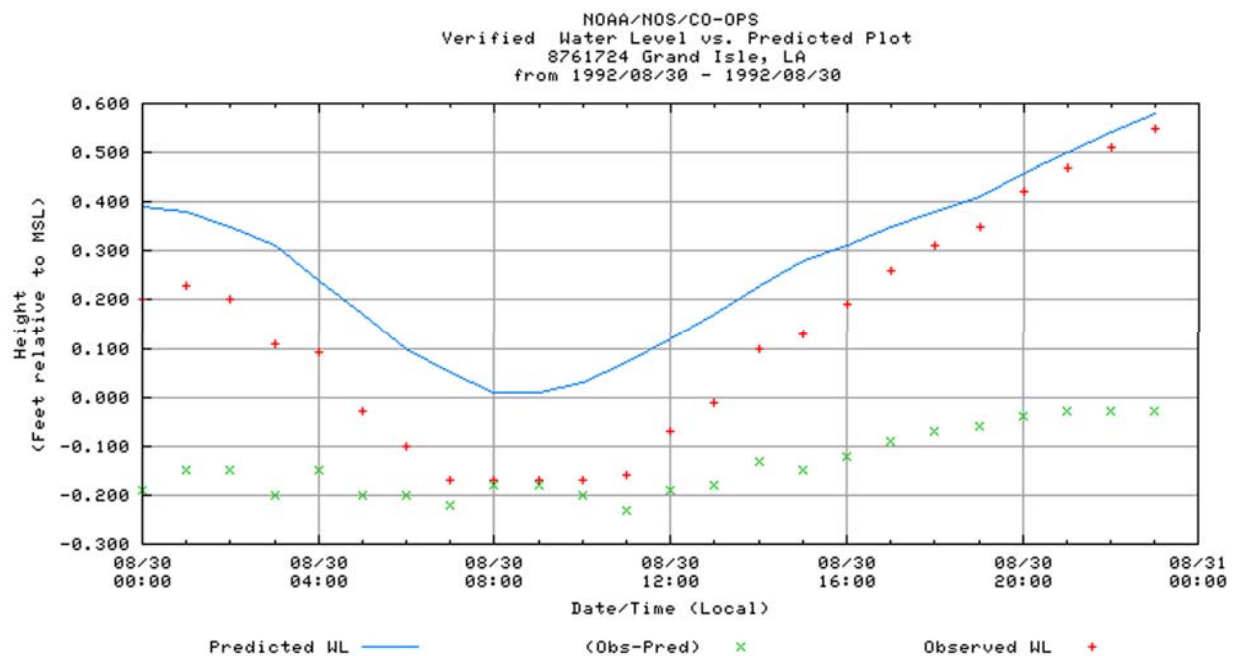


Figure 26. Hourly data available for August 30, 1992 from the Grand Isle East gage, for water levels along the central Louisiana coast during post-hurricane Andrew photo-acquisition. This shows water levels were slightly lower than predicted.

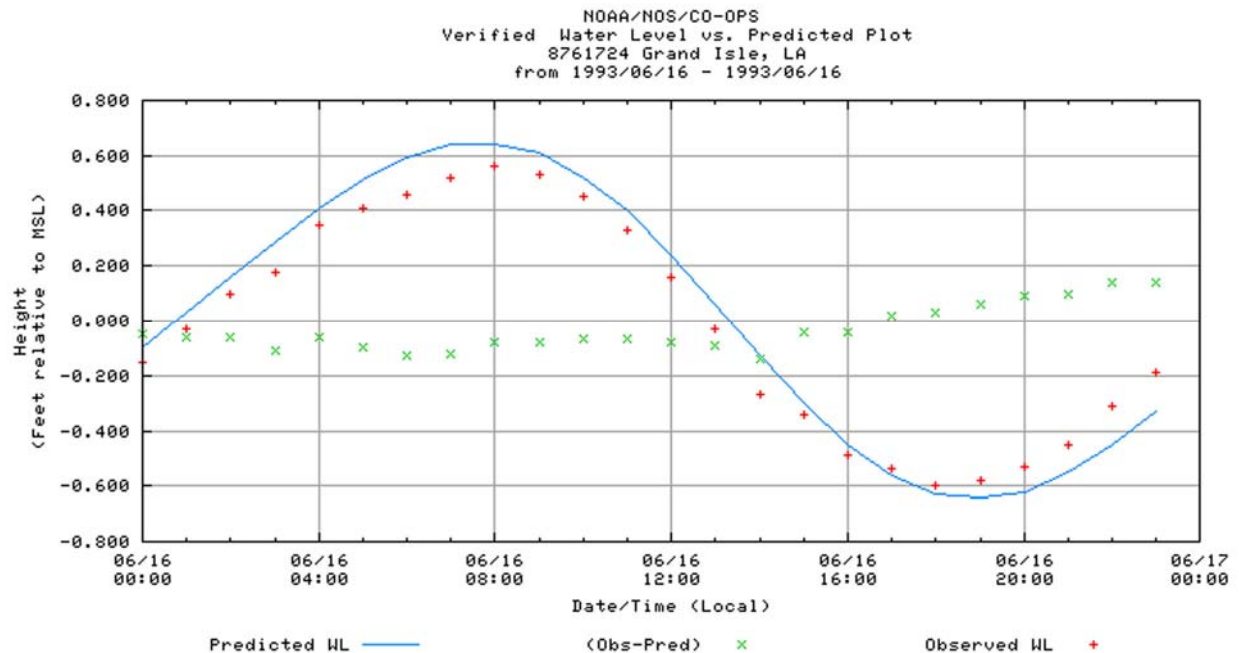


Figure 27. Hourly data available for June 16, 1993 from the Grand Isle East gage, for water levels along the central Louisiana coast during coastal survey photo-acquisition. This shows water levels were as predicted.

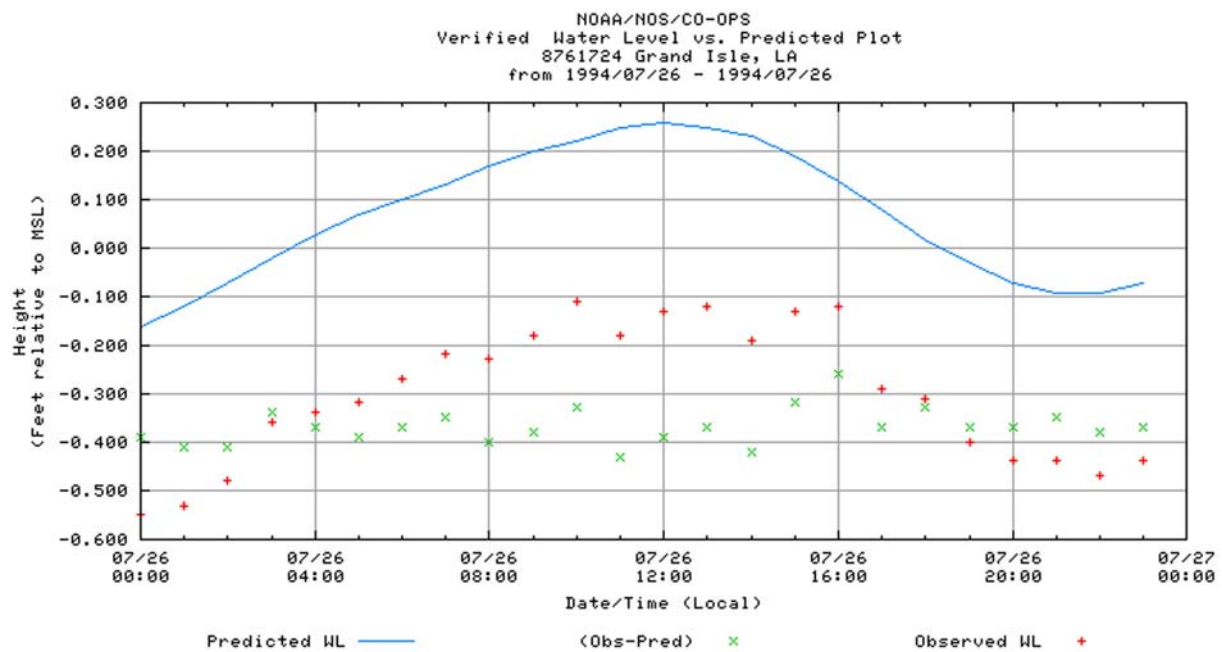


Figure 28. Hourly data available for July 26, 1994 from the Grand Isle East gage, for water levels along the central Louisiana coast during coastal survey photo-acquisition. This shows water levels were less than half a foot lower than predicted.

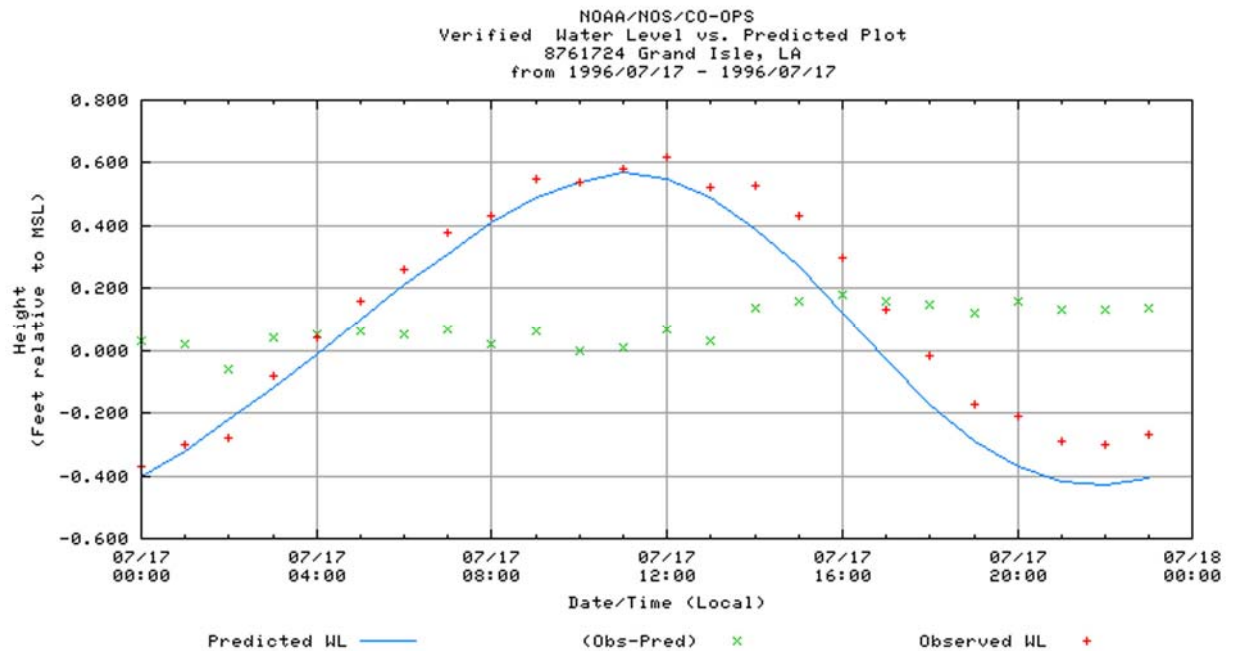


Figure 29. Hourly data available for July 17, 1996 from the Grand Isle East gage, for water levels along the central Louisiana coast during coastal survey photo-acquisition. This shows water levels were as predicted.

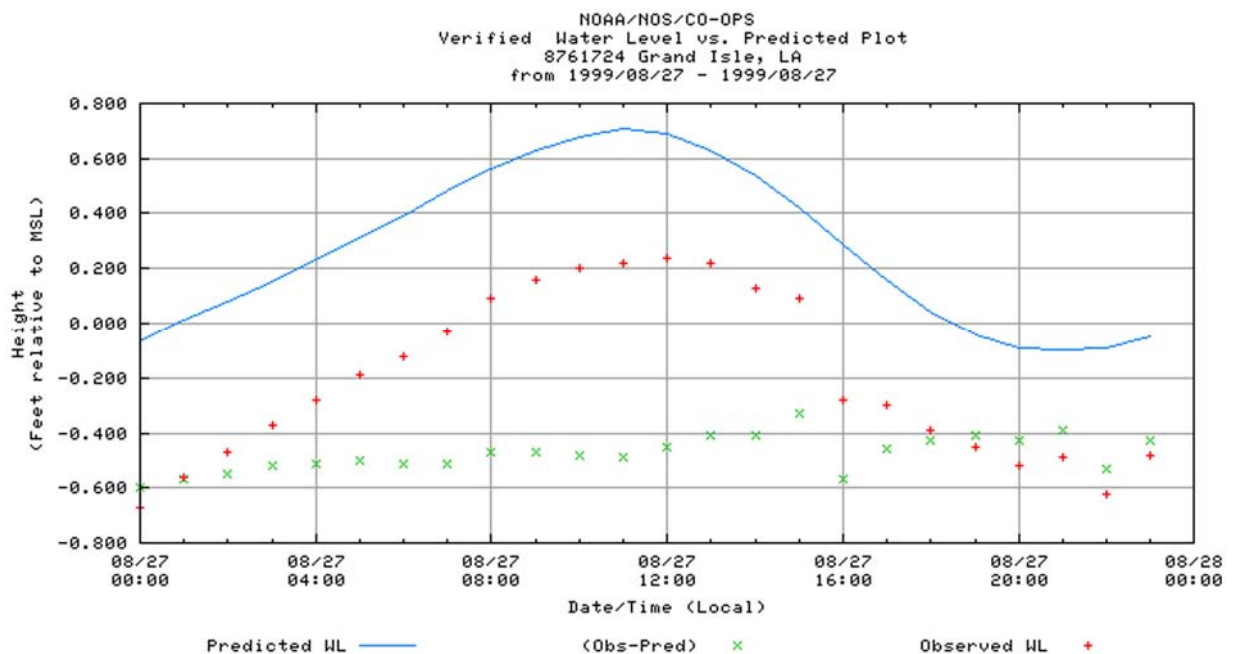


Figure 30. Hourly data available for August 27, 1999 from the Grand Isle East gage, for water levels along the central Louisiana coast during coastal survey photo-acquisition. This shows water levels were half a foot lower than predicted.

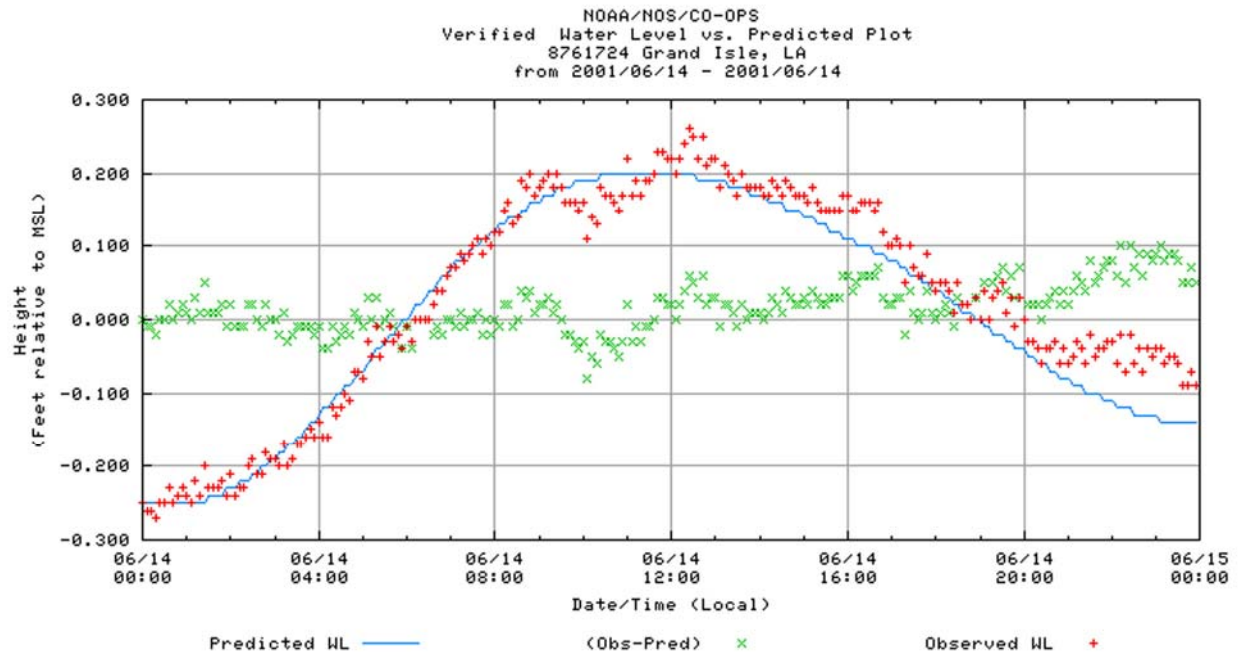


Figure 31. 6-minute data available for June 14, 2001 from the Grand Isle East gage, for water levels along the central Louisiana coast during coastal survey photo-acquisition. This shows water levels were as predicted.

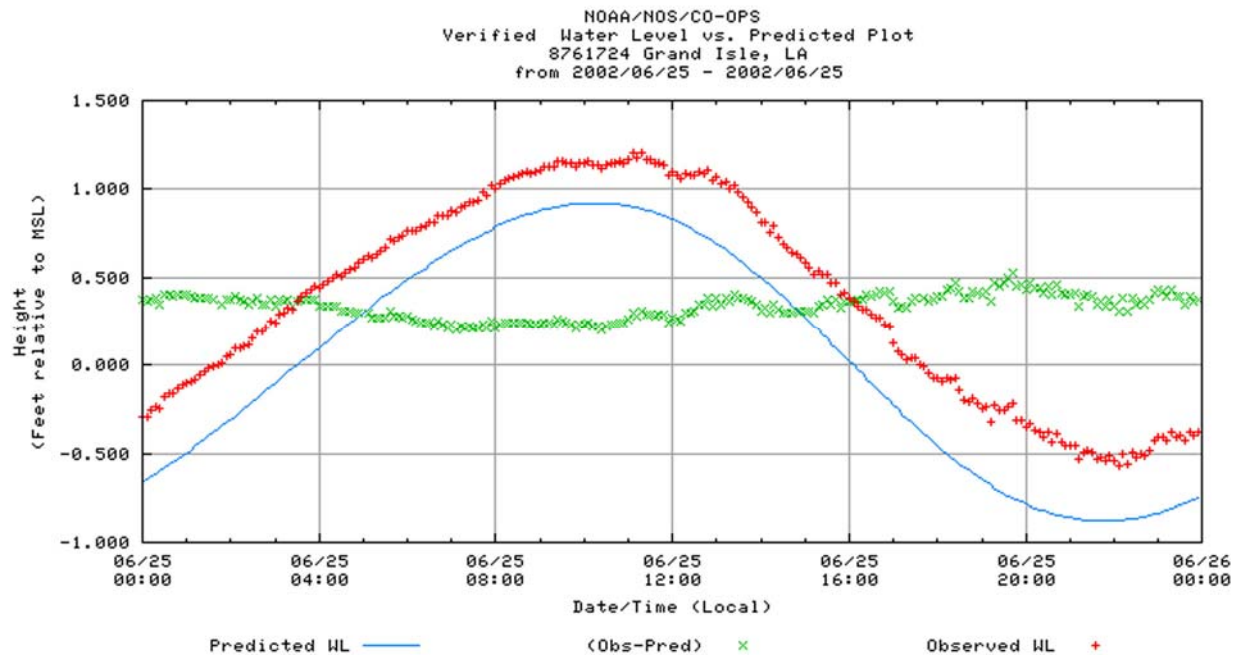


Figure 32. 6-minute data available for June 25, 2002 from the Grand Isle East gage, for water levels along the central Louisiana coast during pre-tropical storm Isidore photo-acquisition. This shows water levels were higher than predicted.

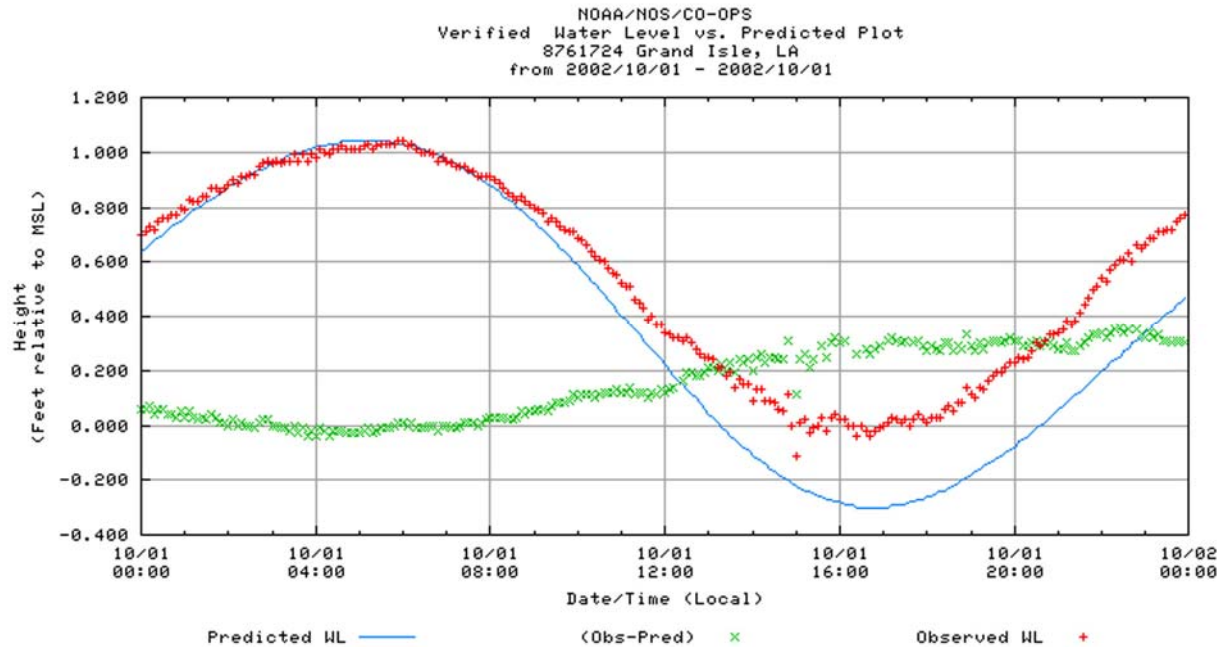


Figure 33. 6-minute data available for October 1, 2002 from the Grand Isle East gage, for water levels along the central Louisiana coast during post-TS Isidore and pre-hurricane Lili photo-acquisition. This shows water levels were as predicted to start the day, but increased into the evening.

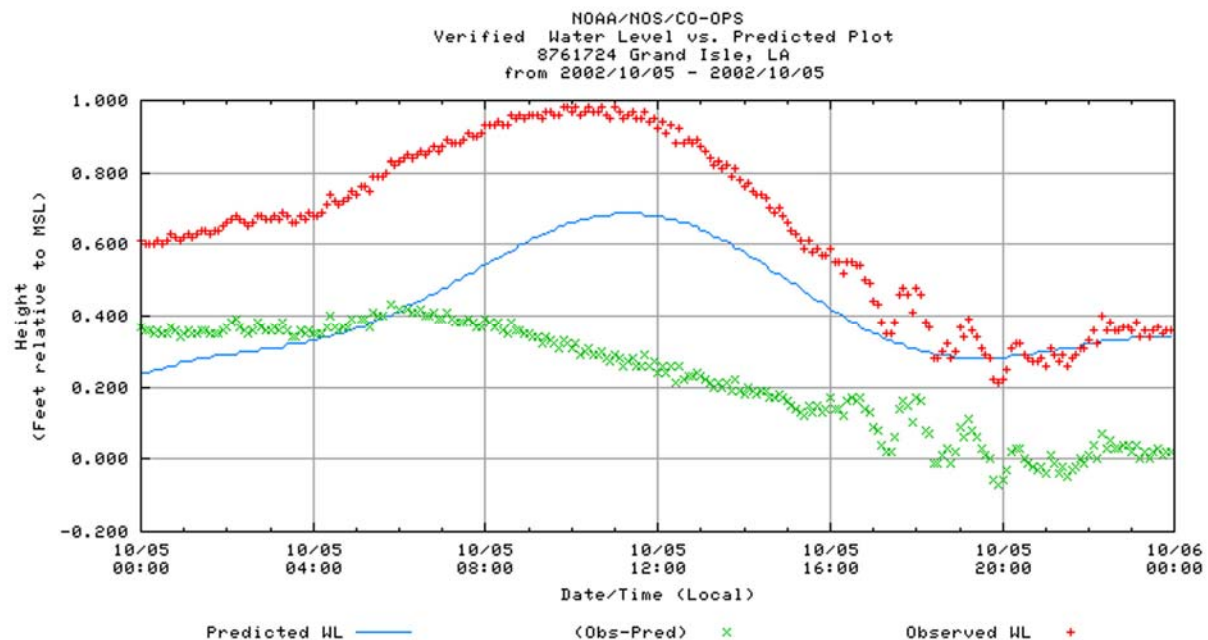


Figure 34. 6-minute data available for October 5, 2002 from the Grand Isle East gage, for water levels along the central Louisiana coast during post-hurricane Lili photo-acquisition. This shows water levels were a half a foot higher than predicted to start the day, but normalized by evening.

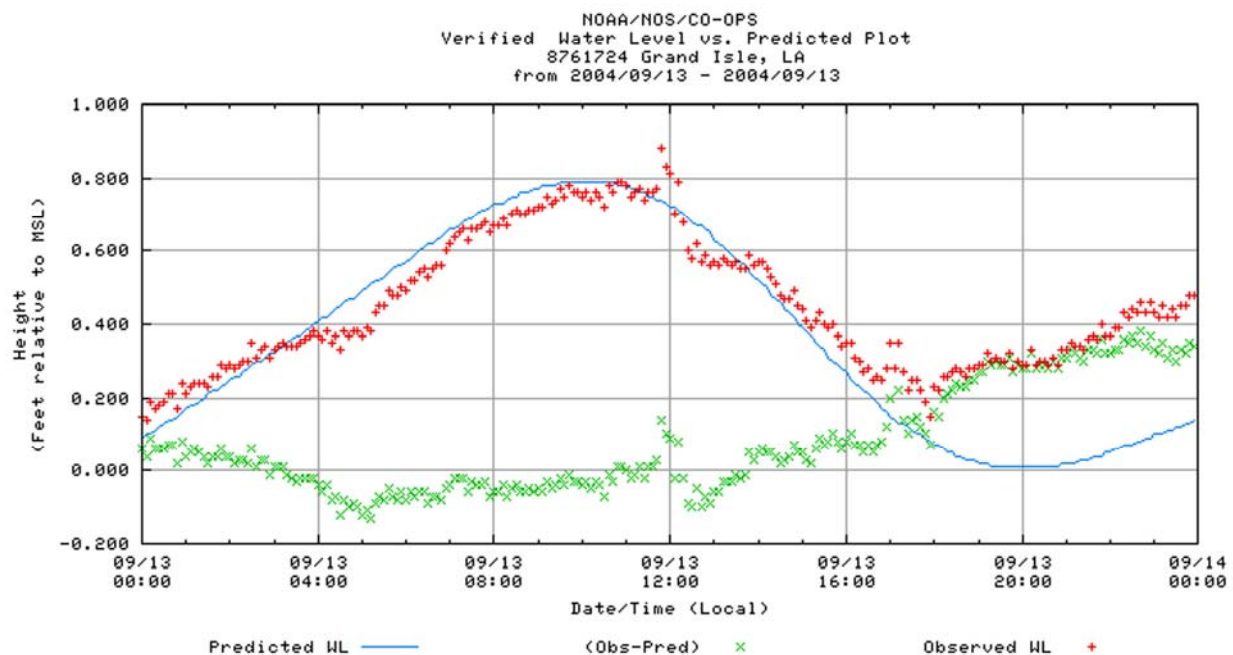


Figure 35. 6-minute data available for September 13, 2004 from the Grand Isle East gage, for water levels along the central Louisiana coast during pre-hurricane Ivan photo-acquisition. This shows water levels were as predicted until evening.

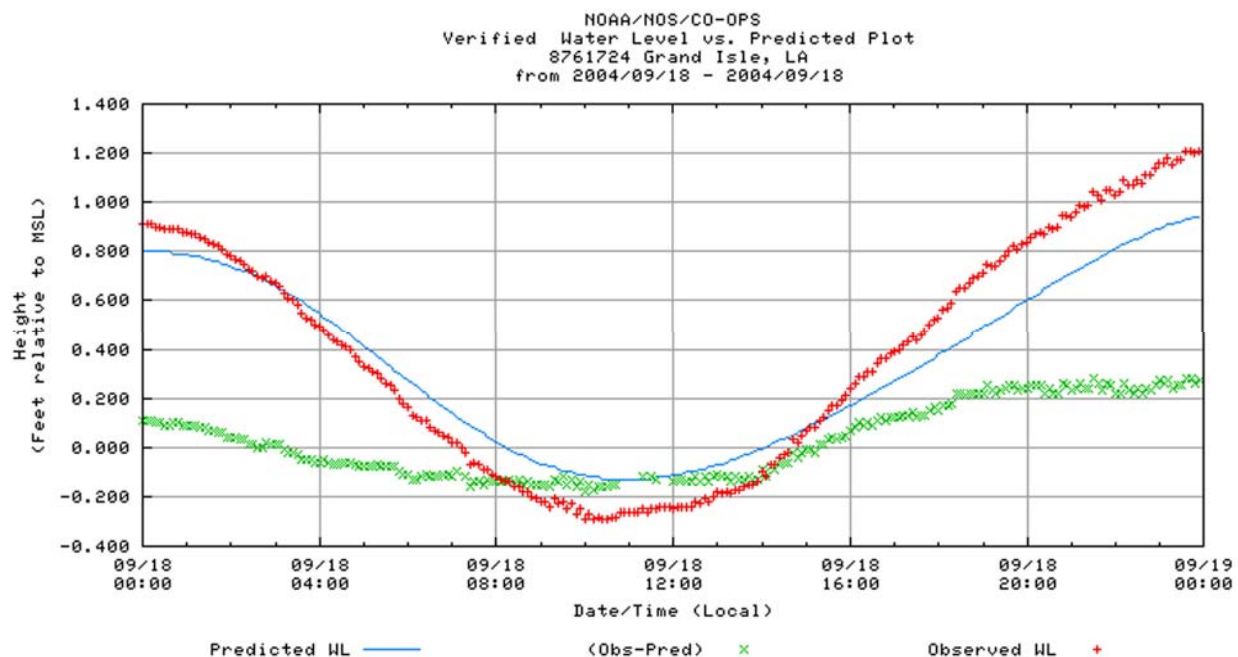


Figure 36. 6-minute data available for September 18, 2004 from the Grand Isle East gage, for water levels along the central Louisiana coast during post-hurricane Ivan photo-acquisition. This shows water levels were near that predicted.

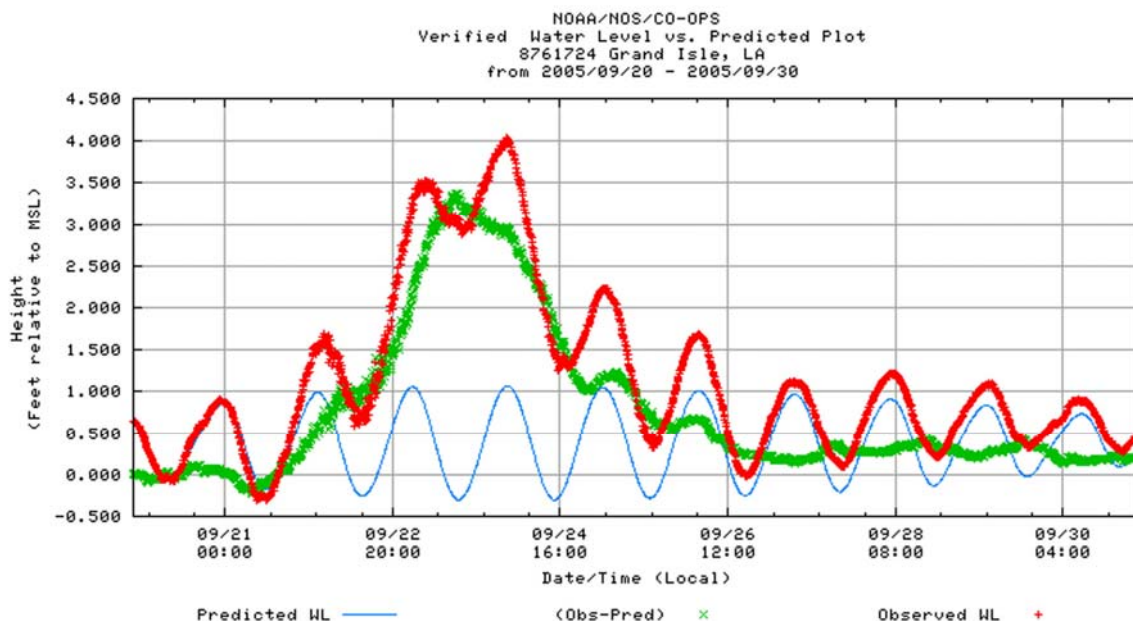


Figure 37. Graph of the tide levels at Grand Isle, East Point for September 20-30, 2005, bracketing the landfall of Hurricane Rita on 9/24 and photo acquisition on 9/28 showing the predicted and observed data for the vicinity of BICM regions Teche Delta and Lafourche Delta.

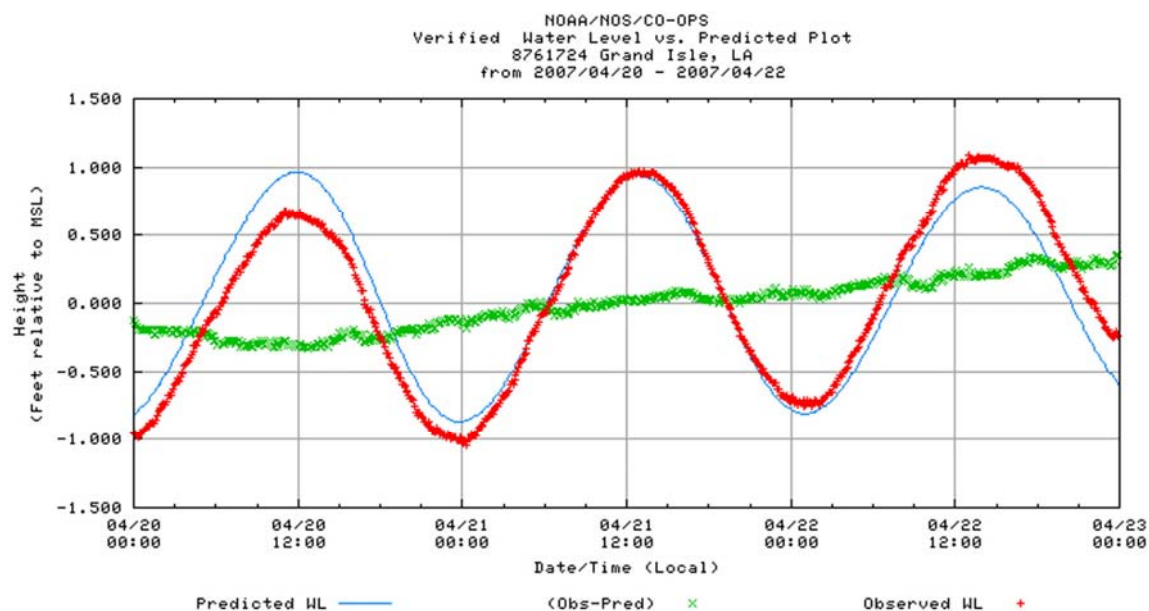


Figure 38. Graph of the tide levels at Grand Isle East Point, LA for April 20-22, 2007 during photo acquisition on 4/20 for south eastern Louisiana. This shows that the observed water levels were normal and close to those predicted for the vicinity of BICM regions Teche Delta, Lafourche Delta and Modern Delta.

Chandeleur BICM region – There were no consistent data at any of the stations surrounding the Chandeleur Islands. Grand Pass, LA had monthly data from 1984 to 1987 (Figure 5), Bay St. Louis Waveland Yacht Club had monthly data from 1984 to 1995 and then 2005 to present (Figure 6). The Gulfport Harbor had 6-minute data only for the more recent dates (Figures 39-40).

(<http://tidesandcurrents.noaa.gov>).

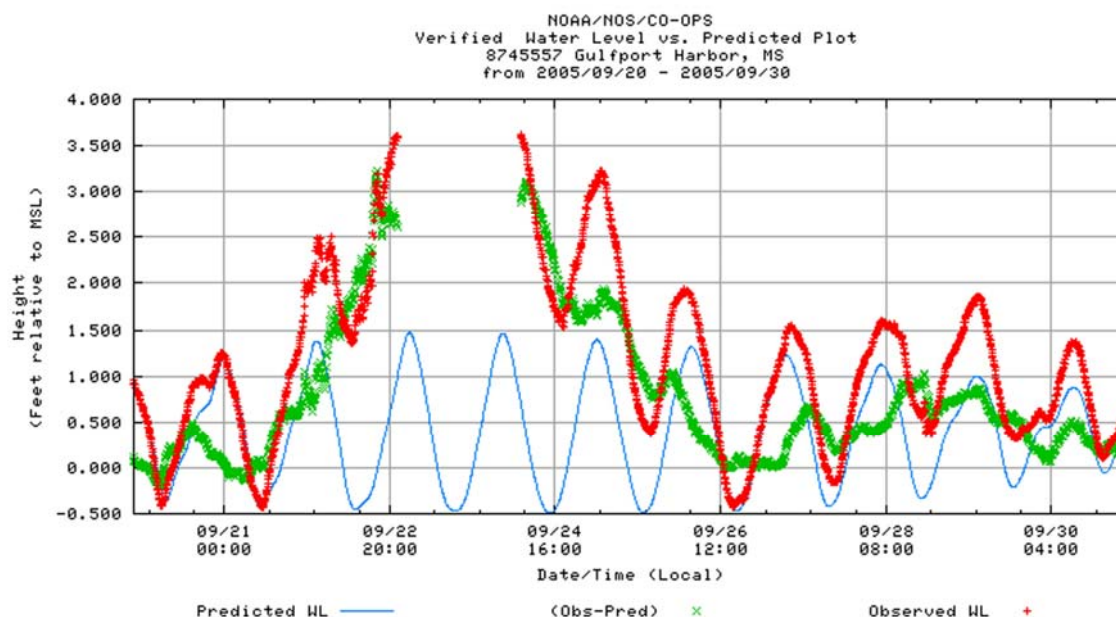


Figure 39. Graph of the tide levels at Gulfport, MS for September 20-30, 2005, bracketing the landfall of Hurricane Rita on 9/24 and photo acquisition on 9/30 showing the predicted and observed data for the vicinity of BICM region Chandeleur Islands. (<http://tidesandcurrents.noaa.gov>).

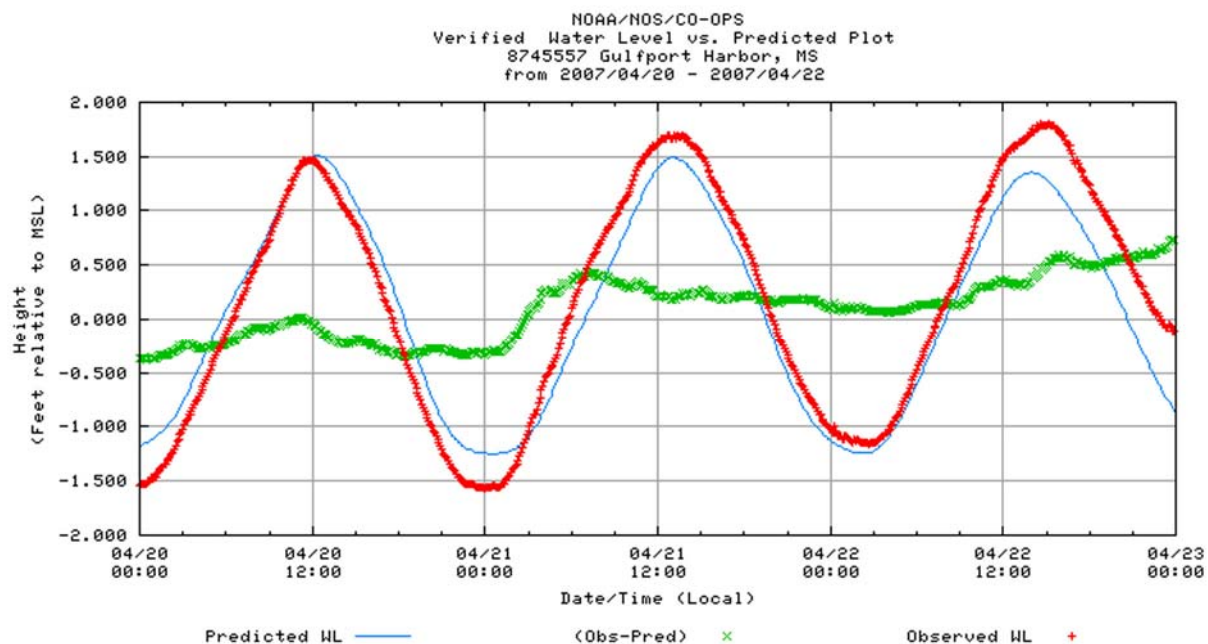


Figure 40. Graph of the tide levels at Gulfport, MS for April 20-22, 2007 during photo acquisition on 4/21 for eastern Louisiana. This shows that the observed water levels were normal and close to those predicted for the vicinity of BICM region Chandeleur Islands. (<http://tidesandcurrents.noaa.gov>).

Location Diagrams for the Historic Photo-Pairs (time series)

Locations of the seventeen time series are indicated on the following figures by a red triangle. Time series were compiled for six BICM regions: Western Chenier Plain (Figure 41), Eastern Chenier Plain (Figure 42), Teche Delta (Figure 43), Lafourche Delta (Figure 44), Modern Delta (Figure 45) and the Chandeleur Islands (Figure 46). Other regions are not included for the time series since there are not enough time periods of matching imagery to provide a useful comparison. The background image was taken from the Louisiana Oil Spill Research and Development composite image and shows each complete BICM region.

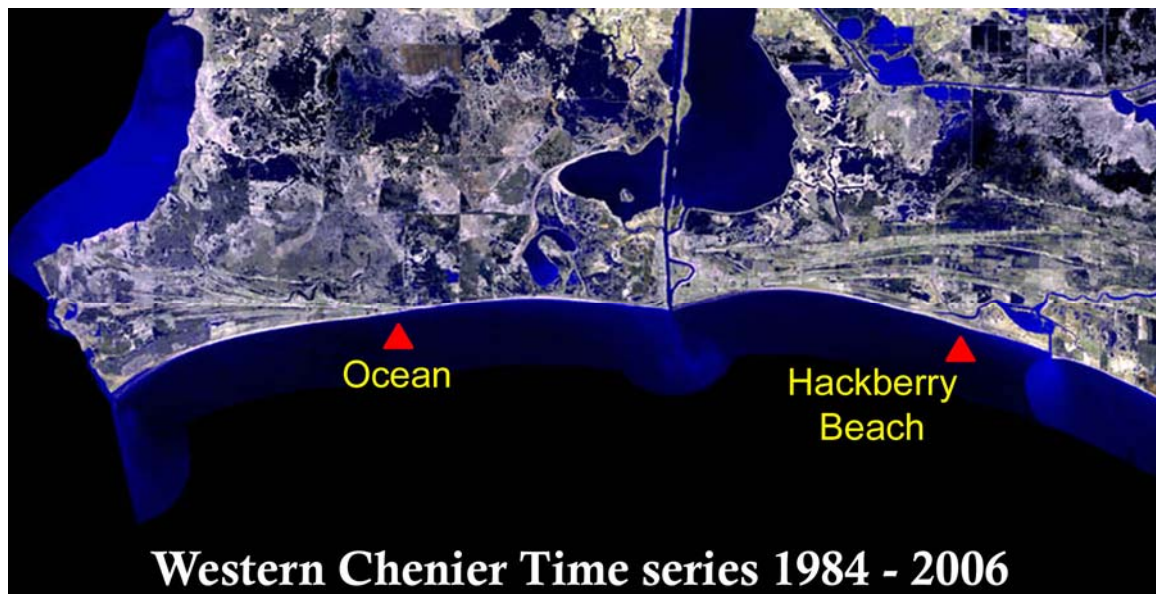


Figure 41. The locations of the two time series compiled along the Western Chenier Plain are indicated by red triangles.

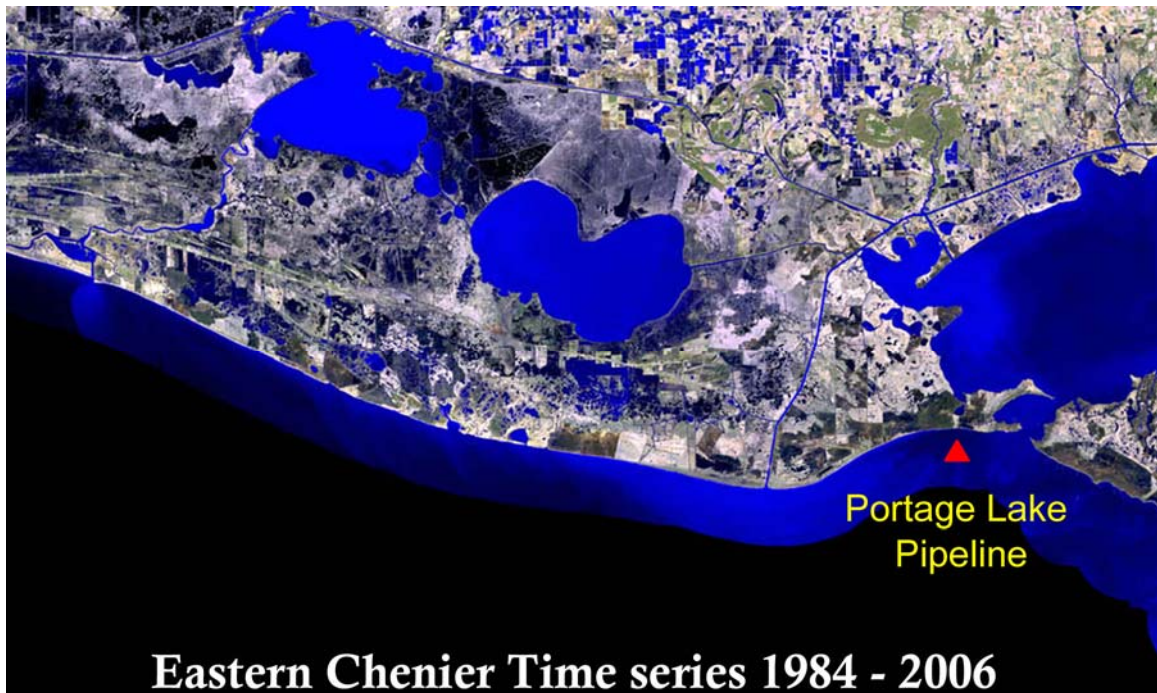


Figure 42. The locations of the time series compiled along the Eastern Chenier Plain are indicated by red triangles.

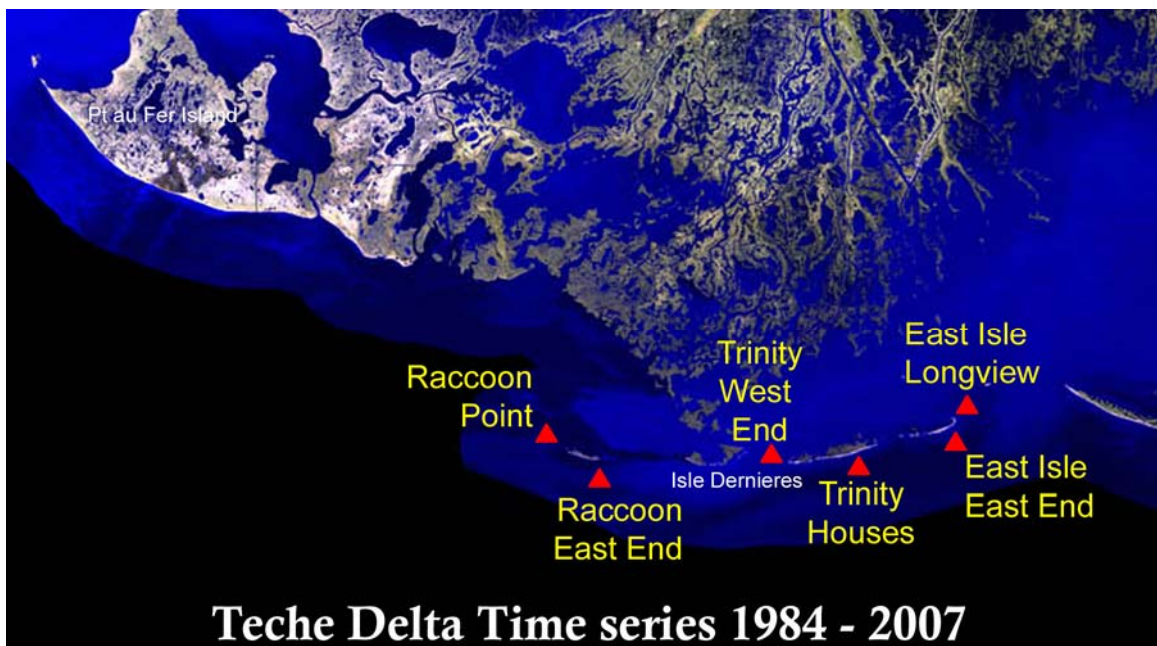


Figure 43. The locations of the seven time series compiled along the Teche Delta shoreline are indicated by red triangles.



Figure 44. The locations of the three time series compiled along the Lafourche Delta shoreline are indicated by red triangles.

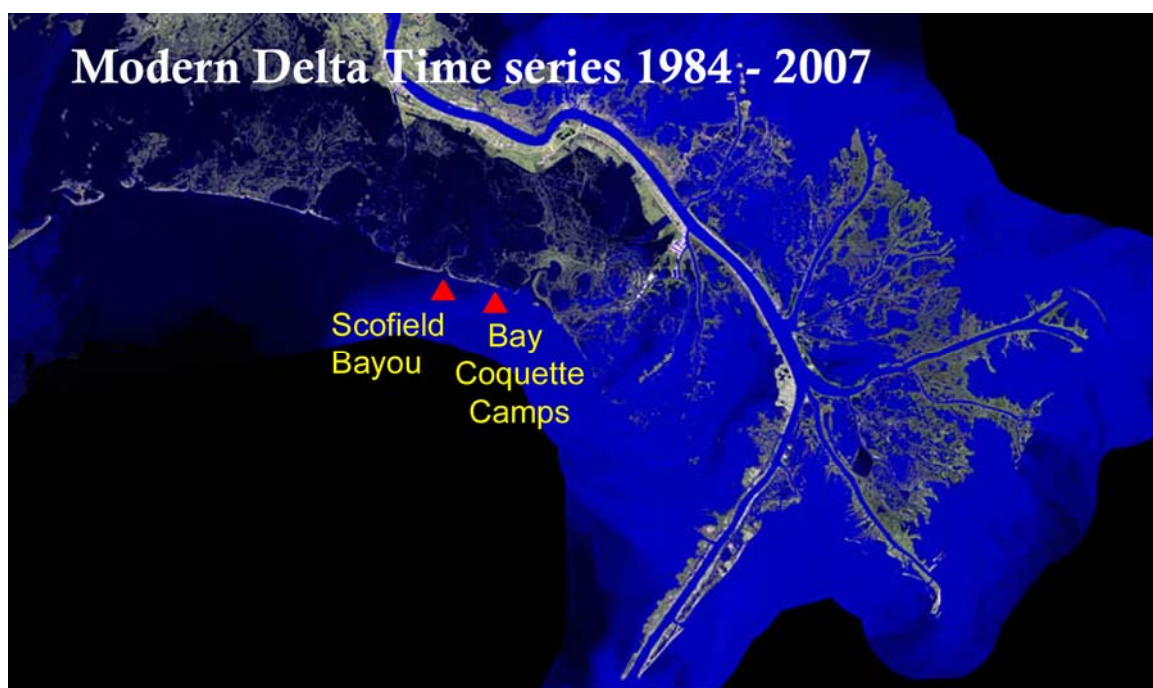


Figure 45. The locations of the two time series compiled along the Modern Delta shoreline are indicated by red triangles.

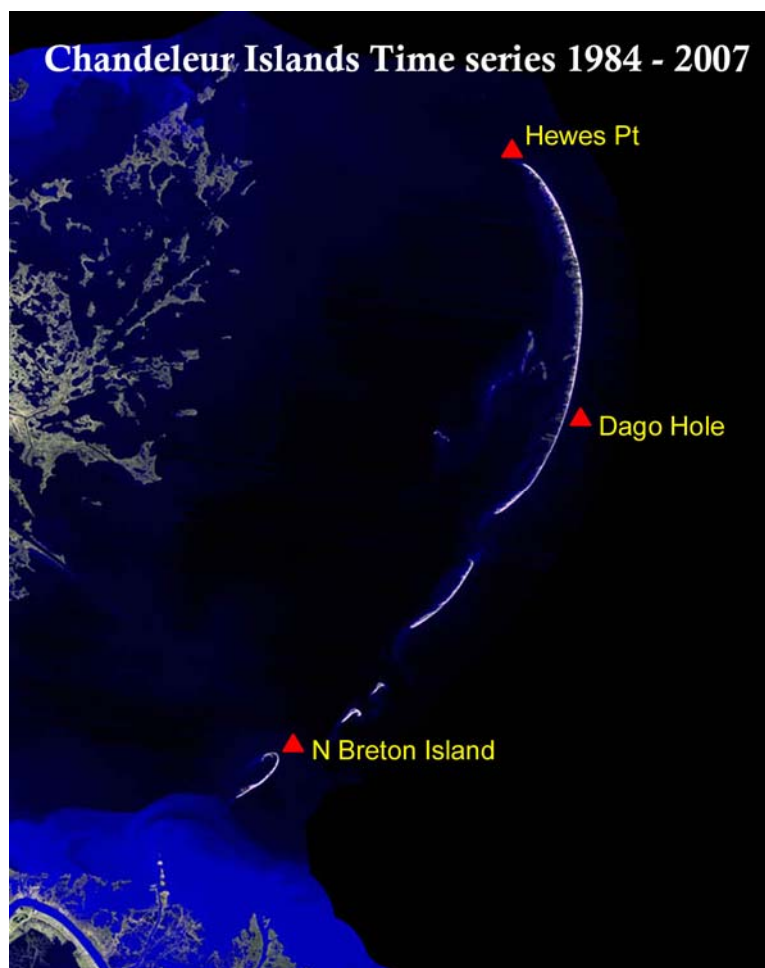


Figure 46. The locations of the three time series compiled along the Chandeleur Islands are indicated by red triangles.

Metadata for Historic Photo-pairs/Time Series

Western Chenier Plain approx lat/long > approx camera angle > Date	005-Ocean 29°45'15"/93°36'19" 355° File name	014-Hackberry Beach canal 29°44'18"/93°02'51" 16° File name
Coastal - July 8, 1984	AVS84_0231-Ocean	AVS84-0429
Coastal - July 9, 1985		
Post-Danny - Aug 24, 1985		
Post-Juan - November 6, 1985		AVS85J-3816-canal
Coastal - July 22, 1986	AVS86_0215-Ocean	AVS86-0532-canal
Coastal - July 7, 1987	AVS87-0314-Ocean	
Coastal - July 13, 1988		AVS88-0604-canal
Coastal - July 18, 1989		AVS89-0237-canal
Coastal - June 24, 1990	AVS90-0415-Ocean	AVS90-0803-canal
Coastal - July 17, 1991		AVS91-0510-canal
Pre-Andrew - July 7, 1992	AVS92-7202-Ocean	AVS92-8036-Hackcanal
Post-Andrew - Aug 29, 1992		
Coastal - June 15, 1993	AVS93-0305-Ocean	AVS93-0621-Hackcanal
Coastal - July 25, 1994		
Coastal - July 11, 1996		AVS96-3228-Hackcanal
Coastal - July 13, 2001	AVS01-0216-Ocean	AVS01-0512-Hackcanal
post-Rita - Sept 28, 2005	APS05R-0450	APS05R-0307
November 20, 2006	AVS06-0084	AVS06-0249
working psd pdf ppt	Ocean.psd CP-Ocean.pdf 005-Ocean.ppt	014-canal.psd CP-HackberryCanal.pdf 014-HackberryCanal.ppt

Eastern Chenier Plain approx lat/long > approx camera angle > Date	023-pipeline 29°35'09"/92°06'33" 0°
Coastal - July 8, 1984	AVS84-0909-pipeline
Coastal - July 9, 1985	
Post-Danny - Aug 24, 1985	
Post-Juan - November 6, 1985	AVS85J-4823-pipeline
Coastal - July 22, 1986	AVS86-1132-pipe
Coastal - July 7, 1987	AVS87-1306-pipeline
Coastal - July 13, 1988	AVS88-1324-pipeline
Coastal - July 18, 1989	AVS89-0729-pipeline
Coastal - June 24, 1990	
Coastal - July 17, 1991	
Pre-Andrew - July 7, 1992	AVS92-8609-pipeline
Post-Andrew - Aug 29, 1992	AVS92A-0130-pipeline
Coastal - June 15, 1993	AVS93-1212-pipeline
Coastal - July 25, 1994	
Coastal - July 11, 1996	AVS96-3604-pipeline
Coastal - July 13, 2001	AVS01-0822-pipeline
post-Rita - Sept 28, 2005	APS05R-0101/102-pipeline
November 20, 2006	AVS06-0560
working psd pdf ppt	023-PortagePipeline.psd CP_PortagePipeline.pdf 023-PortagePipeline.ppt

Teche Delta approx lat/long > approx camera angle > Date	001-Raccoon Island - West end ~29°04'02"/90°57'32" 62° File name	002-Raccoon Island - East end 29°02'51"/90°54'50" 288°	005-Trinity Island - Wend 29°02'42"/90°46'22" 66°	006-Trinity_houses 29°02'50"/90°43'19" 348°	008-EastIsEend 29°04'17"/90°38'05" 284°	009-EastIsElong 29°04'25"/90°38'06" 234°
Coastal - July 9, 1984	AVS84_1318-RI					
Coastal - July 10, 1985	AVS85_0132-RI			AVS85-0718	AVS85_37	
Post-Danny - Aug 24, 1985			AVS85D_0525-TR			
Post-Juan - Nov 6, 1985	AVS85J_0410-RI	AVS85J_0437-RI			AVS85J_0828	
Coastal - July 23, 1986	AVS86_1932-RI	AVS86_2017-RI	AVS86_2437-TR	AVS86-2225	AVS86_2322	AVS86_2325
Coastal - July 9, 1987	AVS87_2403-RI	AVS87_2522-RI	AVS87_2820-TR	AVS87-3025	AVS87_3334	AVS87-3338
Coastal - July 14, 1988	AVS88_2034-RI	AVS88_2121-RI	AVS88_2217-TR		AVS88-2326	
Post-Gilbert Oct 12, 1988				AVS88G_0413	AVS88G_0521	AVS88G_0523
coastal - July 19, 1989	AVS89_1222-RI		AVS89_1417-TR	AVS89_1611		
Coastal - June 25, 1990	AVS90_2015-RI		AVS90_2321-TR	AVS90_2420	AVS90_2701	AVS90_2702/2703
Coastal - July 18, 1991	AVS91_1929-RI	AVS91_2014-RI	AVS91_2110-TR	AVS91-2131		AVS91_2225
Coastal - July 9, 1992		AVS92_10605-RI	AVS92_10704-TR	AVS92_107-21	AVS92_10826	AVS92_10828
Post-Andrew - Aug 30, 1992	AVS92A_1223-RI	AVS92A_1305-RI		AVS92A-1438	AVS92A_1608	AVS92A_1609
Coastal - June 16, 1993	AVS93_3527-RI	AVS93_4138	AVS93_3726-TR	AVS93_4323	AVS93_3917	AVS93_3918
Coastal - July 26, 1994	AVS94_2004-RI	AVS94_2110-RI	AVS94_2205-TR	AVS94_2228	AVS94_2324	AVS94_2326
Coastal - July 17, 1996	AVS96_5537-RI	AVS96_5616-RI	AVS96_5717-TR	AVS96_5736	AVS96-5834	AVS96_5838
Coastal - August 27, 1999	AVS99_0211-RI	AVS99_0311-RI	AVS99_0705-TR	AVS99_0803	AVS99-0936	
Coastal - June 14, 2001	AVS01_1916-RI	AVS01_1938-RI	AVS01_2104-TR	AVS01_2117	AVS01-2202	AVS01-2205
Pre-Isodore - June 25, 2002	APS02-DUPE					
Post-TS Isodore - Oct 1, 2002	APS02_1230		AVS02I_0226	AVS02I_0310/0311	APS02I-0410	APS02I-0411
Post-Lili - Oct 5, 2002	APS02L_1231	APS02L_1213/1212	APS02L_1123	APS02L-1032/1033	APS02L-1008	APS02L-1006
Pre-Ivan - Sept 13, 2004	APS04_1205-RI	APS04_1124/1123	APSO4_1032	APSO4_1020	APS04_0934	APS04-0932 E Isle
post-Ivan - Sept 18, 2004	APS04I_0562	APS04I_545-RI	APSO4I_0572	APSO4I_0508	APS04I_0482	APS04I-0480
post-Rita - Sept 30, 2005	APS05R_0064	AVS05R_0037	APS05R_0686	APS05R_0662	APS05R_0633	APS05R-0627
Coastal - February 26, 2007	AVS07_02-0009	AVS07-02_0042	AVS07-02_0090		AVS07-02_0160	AVS07-02_0166
Coastal - April 20, 2007	AVS07_04-1419	AVS07-04_1457	AVS07-04_1508	AVS07-04_1554	AVS07-04_1594	AVS07-04_1598
working psd ppt pdf	001-RI-Wend-timeseries.psd ID-RaccoonWend.ppt ID-RaccoonWend.pdf	002-RI_eastend.psd ID_RaccoonEend.ppt ID-RaccoonEend.pdf	005-TrinityWend.psd 005-TrinityWend.ppt ID-TrinityWend.pdf	006-TrI-houses.psd 006-TrI-timeseries.ppt ID-Trinityhouses.pdf	008-EastIsEend.psd EastIsle-Eend.ppt ID-EastIsle-Eend.pdf	009-EastIsElong.psd 009-EastIsElong.ppt ID-EastIsElong.pdf

Lafourche Delta approx lat/long > approx camera angle > Date	005-ETI W facility	012- LOOP	001-WGT Fort Livingston 29°16'17"/89°56'41" ~ 321° File name	024-West Grand Terre 29°16'47"/89°55'33" 332°
Coastal July 9, 1984	AVS84_1712	AVS84_1727	AVS84_2005	AVS84-2010-WGTmid
pre-hurricanes - July 10, 1985			AVS85_2533	
Post-Danny - Aug 24, 1985				
Post-Juan - Nov 6, 1985			AVS85J_1427	
Coastal - July 23, 1986	AVS86_2810	AVS86_3003		
Coastal - July 9, 1987	AVS87_4011	AVS87_4202		
Coastal - July 14, 1988		AVS88_2926	AVS88_3134	
Post-Georges Oct 12, 1988	AVS88G-0812-ETI		AVS88G_1218	
Coastal - July 19, 1989			AVS89_2929	
Coastal - June 25, 1990	AVS90_3327	AVS90_3632	AVS90_4320	AVS90_4330-WGT
Coastal - July 18, 1991			AVS91_3521	
Coastal - July 9, 1992	AVS92_11202	AVS92_11337	AVS92_11725	AVS92_11731-WGT
Post-Andrew - Aug 30, 1992		AVS92A_2015	AVS92A_2226	
Coastal - June 16, 1993	AVS93_4822	AVS93_5030	AVS93_5510	AVS93_5516-WGT
Coastal - July 26, 1994	AVS94_2525		AVS94_2820	AVS94_2829-WGT
Coastal - July 17, 1996		AVS96-6237	AVS96_6415	AVS96_6420-WGT
Coastal - August 27, 1999	AVS99_1427/1428	AVS99_1615	AVS99_2009	AVS99_2020
Coastal - June 14, 2001		AVS01_3013	AVS01_3203	AVS01-3208
Post-TS Isodore - Oct 1, 2002		APS02I-0804	APS02I-1007	APS02I-1014
Post-Lili - Oct 5, 2002	AVS02L_0825/24	AVS02L_0709	APS02L-0434	APS02L-0427
Pre-Ivan - Sept 13, 2004	APS04-0804-ETI-E	APS04-0612-LOOP	APS04-0408 WGT	APS04-0403
post-Ivan - Sept 18, 2004			APS04I_0283	APS04I_0276
post-Rita - Sept 30, 2005	APS05R-0547	APS05R-0501	APS05R_0407	APS05R_0398
Coastal - February 26, 2007	AVS07-02_0317	AVS07-02-0408	AVS07-02_0548	AVS07-02_0561
Coastal - April 20, 2007	AVS07-04_1744	AVS07-04_1850	AVS07-04_1985	AVS07-04_1997
working psd ppt pdf	005-ETI-facility.psd BS-ETIfacility.ppt BS-ETIfacility.pdf	012-LOOP.psd BS-LOOP.ppt BS-LOOP.pdf	001-FtLivingston.psd BS-FortLivingston.ppt BS-FtLivingston.pdf	002-WGT.psd BS-WGrandTerre.ppt BS-WGrandTerre.pdf

Modern Delta approx lat/long > approx camera angle > Date	011-Scofield Bayou 29°14'38"/89°34'00" 3° File name	013-Plaq camps 29°13'56"/89°31'22" 18° File name
Coastal - July 8-9, 1984	AVS84_2223-Scofield	AVS84_2234-camps
Pre-hurricanes - July 10, 1985		
Post Juan - Nov, 1985	AVS85J_3204-Scofield	
Coastal - July 23, 1986	AVS86_3614-Scofield	AVS86-3632
Coastal - July 9, 1987	AVS87_4726-Scofield	
Coastal - July 14, 1988	AVS88_3329-Scofield	AVS88_3404
Post-Gilbert - Oct 12, 1988	AVS88G-1602-Scofield	AVS88G_1615
Coastal - July 19, 1989	AVS89_3530-Scofield	
Coastal - June 25, 1990	AVS90_4837-Scofield	AVS90_4919
Coastal - July 18, 1991	AVS91-4015-Scofield	
Coastal - July 9, 1992	AVS92-12204-Scofield	AVS92_12222
Post-Andrew - Aug 30, 1992	AVS92A-2605-Scofield	AVS92A_2622
Coastal - June 16, 1993	AVS93-5815-Scofield	AVS93_5826
Coastal - July 26, 1994		AVS94_3113
Coastal - July 17, 1996	AVS96-6627	AVS96_6637
Coastal - August 27, 1999		AVS99_2528
Coastal - June 14, 2001	AVS01-3516-Scofield	AVS01_3527
Post-TS Isodore - Oct 1, 2002		
Post-Lili - Oct 5, 2002	APS02L-0127	AVS02L_0115/0114
Pre-Ivan - Sept 13, 2004	APS04-0123	APS04-0113
Post-Ivan - Sept 18, 2004	APS04I_0198	APS04I_0187
Post-Rita - Sept 30, 2005	APS05R_0317	APS05R_0305
Coastal - February 26, 2007	AVS07-02_0764	AVS07-02_0791
Coastal - April 20, 2007	AVS07-04_2191	AVS07-04_2222
working psd ppt pdf	011-Scofield.psd 011-Scofield.ppt PS-Scofield.pdf	012-PlaqCamp.psd PS-CoquetteCamps.ppt PS-CoquetteCamps.pdf

Chandeleur Islands approx lat/long* > approx camera angle >	001B-Hewes Point 30°03'08"/88°52'41" 129°	006-Dago 29°48'33"/88°50'29" 291°	011-N Breton 29°29'48" / 89°10'06" 223°
Date	File name	File name	File name
Coastal - July 10, 1984	AVS84_2817-Npt		AVS84_2330
Pre-hurricanes - July 13, 1985	AVS85_2811/4619	AVS85-4303	AVS85_3908
Post-Danny- August 24, 1985			
Post-Juan - November 7, 1985	AVS85J_2624	AVS85J-2020	
Coastal - July 24, 1986	AVS86_4416		AVS86_3820
Coastal - July 10, 1987	AVS87_6123	AVS87-5908	AVS87_5615
Coastal - July 16, 1988	AVS88_4530		
Post-Gilbert - October 13, 1988			
Coastal - July 19, 1989	AVS89_4426	AVs89-4228	AVS89_3910
Coastal - June 26, 1990	AVS90_6231		
Coastal - July 20, 1991	AVS91_5110	AVs91-4713	AVS91_4236
Pre-Andrew - July 10, 1992	AVS92_14104	AVS92-13637	AVS92_13232
Post-Andrew - Aug 30, 1992			
July 14, 1993	AVS93_7624	AVS93-7236	AVS93_6824
July 29, 1994		AVs94-3612	
July 18, 1996	AVS96_8014		
Post-Georges - Oct 1, 1998	AVS98_X732		AVS98G_X123
August 28, 1999	AVS99_3505	AVS99-3133	AVS99_2725
June 15, 2001	AVS01_4203		AVS01_3635
	APS02-08/09		
Post-Isodore - Oct 1, 2002	APS02I-10	APS02I_S327	APS02I_S425
Post-Lili - Oct 5, 2002			
Pre-Ivan - Sept 13, 2004	APS04_1616		
Post-Ivan - Sept 18, 2004	APS04I_0003		APS04I-0155
post-Rita - Sept 28, 2005	APS05R_0151	APS05R_0205/06	APS05R_0267
February 27, 2007			AVS07-02_0888
April 21, 2007	AVS07-04_2951	AVS07-04_2850	AVS07-04_2765
working psd ppt	001B-HewesPt.psd 001B-HewesPt.ppt CI-HewesPt.pdf	006-Dago.psd 006-DagoHole.ppt CI-DagoHole.pdf	011-N-Breton.psd 011-NBreton.ppt CI-Nbreton.pdf

*lat/long based on AVS01
positions.